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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 1 JANUARY, 1925 NUMBER 1

THE RELATION OF THE ENDOCRINE GLANDS TO THE DISORDERS OF THE EAR, NOSE AND THROAT*

A. J. CARLSON, M.D.

CHICAGO

One group of diseases of the ear, nose and throat are mechanical results of physical deformities, sometimes congenital, sometimes secondary effects of infections or other destructive agencies, sometimes the results of glandular hyperplasias or abnormal growth of cartilage and connective tissues. A second group of diseases of these regions are the infections. A third group seems to be due essentially to disturbances in the circulation. This applies particularly to the nose, and in some cases to the middle ear. With these circulatory disturbances are frequently associated abnormal irritability of sensory nerves leading to excess reflexes of various kinds. We have what may be called primary hypertrophy of the lymphoid tissues of the nose and throat, that is, the adenoids and the tonsils. The hypertrophy is at times of obscure origin, possibly dietary or irritative, but not certainly related to acute infections. Finally, there is the so-called sclerosis of the internal ear, leading to varying degrees of deafness and the deafness of old age.

The problem that I am asked to discuss is whether any of these groups of diseases are owing, directly or indirectly, to the disturbances of any one or any group of endocrine glands and whether there is evidence or hope that these disturbances in the ear, nose and throat can be ameliorated by administration of ductless glandular products.

The ductless glands are receiving a great deal of attention, both in the sciences and in the arts of medicine today. When outstanding advances or striking cures of important diseases are achieved in any field, it is natural and legitimate that such remedies or therapeutic processes should be tried in conditions not yet definitely related to the etiology or the disease in question. This is legitimate empiricism, and we shall make progress if the work is done scientifically. We delay progress and increase the fog of confusion, so favorable to the faker's trade, if we follow "post hoc" methods. Administration of endocrine products has been tried in practically every condition known to man,

M.C.

* From the Hull Physiological Laboratory of the University of Chicago.

from ingrowing toe-nails to old age, but when I read the clinical reports of successes with every imaginable tissue or endocrine product in cases of every disease, I say frankly I have to be shown. The spermin of Poehl has been used as a general metabolic stimulant or catalyzer and the European medical literature reports good results from the use of this product in Asiatic cholera, syphilis, erysipelas, delirium tremens, carbon monoxid poisoning, chloroform poisoning, impairment of heart and lungs, hemiplegia, paralysis, hysteria, neurasthenia, myelitis, scurvy, marasmus, skin diseases, typhoid fever, toxic goiter, pulmonary tuberculosis, diabetes, anemia and gout. I do not see why any specialty is discriminated against in this array of organotherapy. Surely a cure-all like spermin should be able to affect favorably the tonsils and the adenoids, the diverted septum, the infected middle ear, and the deafness of old age. Funck [1] reports improvements in the protean disease, arteriosclerosis, by feeding "animasa." This amazing "animasa" is said to be an extract of blood vessels and blood proteins. But lest we in America should seem to be outdone by our European brethren, let us turn our attention to the therapeutic effects recently reported in a reputable medical journal from hypodermic injections of fresh testes of goats into 656 persons, including seven women and thirteen physicians. What ailed the seven women that physicians could hope to cure by goat testes administered by needle through the skin is not related, nor what ailed the thirteen physicians; but all except one physician reported good effects from injections. Our colleagues reported therapeutic benefits from this goat gland therapy in asthma, general asthenia, rheumatism, neurasthenia, tuberculosis, senility, sex lassitude, epilepsy, dementia praecox, diabetes and locomotor ataxia. Even more remarkable, forty-one of the injected persons had poor vision and thirty-two of these persons are said to have had better vision after they had received a little goat testes under the skin. The evidence for this effect of testes on vision runs as follows: "Thirty-one of the injected persons reported that their vision was greatly strengthened after injection. One man declared that before his treatment he had difficulty in distinguishing the torpedo boats plying up and down the bay; following two injections he affirmed he not only saw the boats but that he could see the numbers on the boats. He is an accountant and credence should be given his statement." Here again we note that nothing is said concerning the value of goat, boar, ram or deer testes in the cure of diseases of the ear, nose and throat.

What are the endocrine glands and what the essential facts known concerning their functional relation to diseases, and the effects of administration of extracts of these glands in particular or general dis-

1. Funck, C.: Arch. f. Verdauungskr. **29**:167, 1922.

orders? The following organs are generally regarded as belonging to the group of endocrine glands: the ovaries, the testes, the suprarenals, the pancreas, the thyroid, the parathyroids and the hypophysis. There is another group of glands in which the evidence of endocrine function is still in the balance. These are the spleen, the thymus and the pineal body. The liver must undoubtedly be considered in certain respects as an endocrine organ and the same probably applied to some parts of the brain, but the liver and the brain have so many other functions in the body that no distinct diseases have yet been defined as due to failure of endocrine activity of either the liver or the brain, with the possible exception of the relation of the basal part of the midbrain to diabetes insipidus.

The general recognized method of determining the specific function of an endocrine organ is to follow the effects of complete or partial removal of this organ in an otherwise healthy animal, and check this up with the effects of destructive lesions in this organ in man. Obviously, the data on man will be more reliable when the lesions are confined to the organ in question and not generalized. For instance, if the suprarenals are destroyed by tuberculosis but there are no tubercular processes in any other part of the body, and when such a condition produces results similar to the removal of the suprarenals in otherwise healthy animals, we are justified in concluding that the disease parallel with the tuberculosis of the suprarenals is not due to the tuberculosis per se but to the destruction of this particular organ by the tubercular processes. Again, the reliable evidence for so-called organotherapy is secured by similar methods. First, we remove the endocrine organs in question in otherwise healthy animals, and we note the natural history of the sequelae of such removal, then we feed or inject this animal with various preparations of the organ removed and determine to what extent these administrations change the natural history of the defects in the animal following the loss of the organ. Having such experimental data we try to check these up on patients where we have evidence that the disease is due to hypofunction of a specific endocrine gland. By following the same rigid scientific control and reasoning as in the case of the experimental work, we can secure equally reliable data in the clinic as in the laboratory as to the efficiency of a particular endocrine product in a particular malady, but if we do not weigh the patient's statements where they are not checked up by objective tests, if we let our own enthusiasm run away with our judgment, if we forget the natural ups and downs in the malady, and, particularly, if we try a whole series of therapeutics simultaneously (irrespective of what the results in the patients might be) we can draw no reliable conclusions as to the specific effects of the organotherapy in question. If the physician is kind to his

patient and if the patient knows the kind of results his physician likes to have, he will frequently stretch a point and say he feels better, even though he is not certain that he has been actually improved. The only safeguard on this point is rigid objective determinations by the physician himself, or better still, by a competent third party, who does not know what the physician is doing for or with the patient. This is self evident.

With this brief statement of the scientific and the clinical methods of determining the relation of the endocrine glands to particular diseases and the value of endocrine products in the cure of these diseases, I shall now examine the possible relation of the endocrine glands to the main disturbances of the ear, nose and throat. In doing this, time will be saved by eliminating at once the endocrine glands that have not as yet been accused of producing diseases of the ear, nose and throat. These are the gonads. Removal or destructive lesions of the gonads produces no anatomic deformation in the ear, nose or throat that leads to disease. It does not lower the resistance to infection in these regions, it causes no hypertrophy or atrophy in these regions either in man or beast. There is no dispute on this point in the reliable literature or in the minds of well informed men. There are innumerable cases of castrated and spayed animals and men with, so far as I know, no evidence of any greater incidence of ear, nose and throat diseases in the castrated or spayed group than in the normal group. With posssibly one minor exception, we can exclude the ovaries and testes from implication in diseases of the ear, nose and throat, and as a corollary exclude endocrine products from these glands in the treatment of ear, nose and throat disorders. The exception mentioned is the erectile-like tissue in the nose that seems to be functionally associated with the erectile tissue of the external genitalia, and these erectile tissues are again functionally dependent on the ovaries and testes. Also, the neurocirculatory disturbances that may accompany the normal or the artificial menopause in women may, incidentally, involve the vascular system in the ear, nose and throat. However, these seem, at least at present, to be insignificant relations of the gonads to the ear, nose and throat physiology and pathology and afford no warrant for the introduction of an indiscriminate organotherapy of ear, nose and throat with ovarian and testicular products. Possibly mention should also be made of the prevalent view that in some way the physiologic involution of the ovaries and testes are responsible for old age, that is to say, that aging is caused by the gradual failure of the ovaries and testes. If that is the case, one might reasonably expect that the deafness that frequently comes on with aging might also be due to failure of the gonads. This view regarding the gonads as a "fountain of youth" is not well founded.

There is aging in plants and in animals that have no gonads. The phenomena of aging involves the tissues and organs in general, and is far more fundamental than the rather superficial and specific influence of the gonads, although, of course, from the point of view of the maintenance of the race the gonads are essential.

THE SUPRARENAL GLANDS

As we all know, the suprarenals are really double organs and we have clear evidence of the double function. Following the discovery of epinephrin, the product of the suprarenal medulla, over twenty-five years ago, a great deal of attention has been given to the function of the medulla and the possible rôle of the product of the medulla, epinephrin, in health and disease. The sum total of these scientific and clinical investigations is this, that today we appear to know less about the importance of the suprarenal medulla than we thought we knew twenty years ago. One thing seems certain, that the loss of the medulla of the suprarenal is not the primary factor in producing the symptoms of Addison's disease. It is the cortex of the medulla that is necessary for life, and it is an open question whether epinephrin plays any rôle whatsoever or whether it actually is involved in the production of any disease symptoms. But assuming for the present that epinephrin does have a physiologic rôle, that it is involved in the maintenance of normal vascular tone, capillary permeability, blood pressure, etc., is there any evidence that the excess of or diminution of epinephrin plays any rôle in the neurocirculatory disturbances of the ear, nose and throat? The evidence is certainly not convincing. In the first place, while it is true that a clear case of Addison's disease is rare, so far as I know disturbances of the ear, nose and throat are not characteristic symptoms in definite Addison's disease, although vertigo and ear noises may be present. Unfortunately, the completely suprarenalectomized animal dies so quickly that such experiments give us little or no chance to discover or develop chronic disorders of any organ, least of all the ear, nose and throat. But it is a fact that by suitable surgery the suprarenal medulla may be practically completely removed from animals, and so far as I know, these animals develop no disturbances of the ear, nose and throat. Assuming that there is such a thing as hyposuprarenalism (I doubt very much that such a condition exists) we have no reliable evidence that such a condition produces disturbances leading to diseases of the ear, nose and throat. Taking the reverse picture, assuming that acute or chronic excessive output of epinephrin could produce circulatory disturbances, high blood pressure, etc., may not such conditions be causative factors in intumescence, in epistaxis, in tinnitus, etc.? While we admit the possibility, the evidence for it is certainly lacking at present. And even if the evidence was at hand, that would give us

no clear clue to the organotherapy of these disorders, because obviously a disease due to the excess of epinephrin could not be ameliorated by giving more epinephrin. We know no certain way of depressing the suprarenal medulla, I mean ways not injurious to the animal or person. What I have said on this subject does not reflect on the use of epinephrin as a drug for the control or attempt to control local hemorrhage or local hyperemia. In this connection epinephrin is just as valuable and useful as any drug obtained from plants. There is no reason why more useful drugs should not be obtained from animal tissues. There is no reason for suspecting that plants have the monopoly on the development or synthesis of such drugs, but there is a wide chasm between an animal product acting as a drug and an animal product acting as a physiologic hormone, because the animal product acting as a drug is not necessarily produced as a physiologic or pathologic agent in the intact animal.

THE PANCREAS

That marked failure of the endocrine function of the pancreas induces diabetes was established thirty years ago by experiments on dogs. And thirty years of research, mainly on dogs, has given us insulin. In well advanced diabetes there is impairment of tissue repair, and decreased resistance to infection. I am not aware that diabetic patients show an unusually high percentage of ear, nose and throat infections, enlarged adenoids, tonsils, etc. Of course, such insignificant facts should not discourage us from putting pancreas extracts into the pluriglandular pie that we are advised to feed to our patients.

THE HYPOPHYSIS

Our knowledge of the physiology and pathology of the hypophysis, like that of the suprarenals, has advanced backward during the last ten years. It has advanced backward in a certain sense to such a great extent that very little of what Cushing wrote, fifteen years ago, in his monograph on the physiology and pathology of the hypophysis, has stood the test of scientific and clinical analysis during the intervening years. The following facts seem clear. Disorders of the ear, nose and throat are not necessary or characteristic sequelae of either Fröhlich's syndrome or acromegaly. Fröhlich's syndrome is supposed to be due, and there is some evidence of its being due, to impairment of the hypophysis, particularly the anterior lobe. Acromegaly, on the other hand, is supposed to be due to the hyperactivity of the anterior lobe of the hypophysis. Deafness and tinnitus may accompany acromegaly. The latter may be due to vascular disturbances from the high intracranial pressure. The cause of the defective hearing seems more obscure.

It is a further fact that complete removal of the hypophysis in animals used for experiments, does not cause necessary or characteristic disorders of the ear, nose and throat. Continued and exceesive feeding of anterior lobe substance in experimental animals, old or young, produces no distinct lesions or diseases of the ear, nose and throat. These being the admitted facts, what reason is there for roentgen-ray therapy of the hypophysis in deafness; or feeding with hypophysis extracts any patient suffering from lesions in the ear, nose and throat? In the first place, we have in the product of the posterior lobe of the hypophysis, pituitary extract, an interesting and useful drug, interesting and useful more in the field of obstetrics than in otolaryngology, but pituitary extract properly administered has an action on the circulatory system and the heart, and may therefore have some action in neurocirculatory disturbances of the ear, nose and throat. Apart from that there is nothing but guess work, and some curious and unconvincing reports in the medical literature.

Citelli reports favorable results from giving hypophyseal extracts in chronic sinusitis. Wilson treats intumescence successfully with pituitary extract. Stokes [2] has published two papers in which he has outlined a method for the roentgen-ray therapy of the pituitary gland in certain types of deafness, with the usual reports of favorable effects in a high percentage of cases. The patients included cases of otosclerosis. Let us examine his methods and results in the light of facts and reason. Dr. Stokes says: "The ductless glands are generally conceded to be regulators of metabolism and it is fair to assume that the pituitary gland is the head-end of the endocrine gradient, and is active in the regulation of metabolism in the brain and its various receptor mechanisms." We have no quarrel with these assumptions, except for the slight discrepancy that there is at present no evidence that the pituitary gland, directly or indirectly, governs the metabolism of either the brain or its receptors. But Dr. Stokes finds comfort and support in the clinical literature from the fact that: "electronization has been of conspicuous benefit in many conditions, other than impaired hearing, such as epilepsy, infantile paralysis, anosmia, hypertension, neuralgia, convalescence from infectious diseases, etc." He further says: "In electronization, we neither stimulate, nor do we inhibit, and certainly we do not destroy. What we accomplish is more in the nature of rejuvenation or equilibration; we restore the acid-alkali balance in cell protoplasm, and as might be expected, barring unforeseen accidents, the results in the majority of cases are relatively permanent." This would be a delectable piece of pure nonsense except that, coming from a physician, it reflects on all physicians. "When we x-ray the

2. Stokes, C. F.: Am. J. Electrotherap. & Radiol. **41**:351, 1923.

hypophysis we neither stimulate, nor do we inhibit, but certainly we do not destroy it but we rejuvenate and restore the equilibration of the acid-alkali balance in the cell protoplasm." Rejuvenation, that is the catchword of the day. Now, I should like to state that careful experiments by Ivy and Orendorff on the question whether the roentgen ray in any strength or any duration of application is capable of actually stimulating a gland has so far proved absolutely negative. Roentgen-ray treatment, in quantities that affect glands, seems to depress or destroy them without primary stimulation. At present, therefore, on the basis of demonstrated facts, the use of the roentgen ray to stimulate hypo-active glands is not only empirical but contrary to facts. But let us go further in the reports of Dr. Stokes. He does many other things to his patients besides giving them roentgen-ray examination of the hypophysis. "The patients are given a general overhauling, their health habits investigated and corrected; they are referred to an operating aurist for surgical conditions. Many show evidence of endocrine imbalance, others are mildly toxic, and frequently the colon is at fault, these are referred for cecal irrigation and the proper drainage of the digestive tract. This is followed by the use of the Morse Wave Generator.

"At the second visit the roentgen-ray treatment is preceded by mild diathermy through the auditory region, followed by mild high frequency. This is followed by inflation with a nebulizer. The next step is mild pneumovibration, through the index finger, which is inserted into the external auditory meatus. At this point various other measures are employed, if indicated, such as vibration of the region of the vertebra prominens (it is not stated whether it is the first cervical or the last caudal vertebra which is being vibrated), or high frequency in that region, or both, or the diathermic massage of Turrell. In chronic catarrh, ultraviolet light, water cooled lamp and quartz applicators are used in the larynx or pharynx or both. Where there is stiffness or soreness, or possibly a neuralgic condition, the deep therapy lamp is used. Then follows the roentgen-ray treatment and the sitting is completed by an exposure, lasting for forty seconds, to the air cooled quartz lamp to each side of the head." After all this general overhauling and hocus-pocus, the better hearing said to be reported by his patients are ascribed to a rejuvenation and restored acid-alkali balance produced by the roentgen ray acting on the hypophysis. "O tempora! O mores!" After a critical study of these reports of Dr. Stokes, one wonders what influence the late Dr. Abrams had in the introduction of this selective "electronization" of the hypophysis in the deaf.

In this connection I should like to remark that in attempting to use the roentgen ray on the hypophysis, it is probably impossible to completely exclude the internal ear from the roentgen-ray field. If the theory that otosclerosis, or at least some cases of otosclerosis, is due to

hypertrophy or abnormal growth of cartilage or new bone in the internal ear, irradiating the internal ear might arrest otosclerosis by the destructive action of the roentgen ray on these cells. Assuming the cartilage hypertrophy theory as the genesis of ostosclerosis, the roentgen-ray therapy of the internal ear as an empirical therapy of those conditions, particularly if started early in the disease, seems worthy of a thorough investigation and trial, but let us not render the profession ridiculous by pretending that shooting the roentgen rays in the general direction of the hypophysis produces "rejuvenation and restoration of the acid-alkali balance in the cells," of the hypophysis and in consequence of this restores hearing. It is noted that Janlin, Schwartz, Orloff, Frey and Kriser have reported on the application of the roentgen ray to the internal ear in otosclerosis. The results are conflicting.

THE PARATHYROIDS

The parathyroid glands are endocrine organs of very great importance in normal life. The relation of these glands to constitutional diseases is probably far more complex than at present realized, but just how the failure of the gland produces disease is an open question. There is, however, no evidence that hypofunction or hyperfunction of the parathyroids are factors in the hitherto recognized diseases of the ear, nose and throat, even if we admit that the parathyroids are involved in bone and calcium metabolism. But there are those who recommend and report cures of such disease by parathyroid organotherapy despite the fact that we cannot, at present, cure or control parathyroid tetany by parathyroid organotherapy. Kriser has reported on irradiating the parathyroid glands as a therapeutic measure in otosclerosis. It is, of course, impossible to irradiate the parathyroids without at the same time irradiating the thyroids. Harrower recently sent out a little pamphlet entitled "New and Strange Uses for Parathyroid Therapy." I welcome the "new and strange" when supported by facts and reason. These new and strange uses include parathyroid organotherapy for chronic otitis media and sinusitis. I quote from a physician in San Jose, Calif., who has been suffering from a chronic frontal sinusitis for years and says: "I will state that about one month ago I started taking your Parathyroid Co. to see if I could influence a chronic frontal sinus condition that has persisted for several years. Although I am not well I am satisfied that I have improved, as I have not had an acute flare-up of the trouble during the last month and the discharge has decreased." This is no proof of a cure but it is a hint of a "new and original method of prospective benefit." Prospective benefit to Dr. Harrower, of course. In fact it sounds like the selling talk of a Los Angeles real estate agent. Quoting again: "Several workers have

already found that a chronic running ear of years' standing may respond to this treatment, provided the conditions are not acute and there is no need for the release of pent-up pus. Many cases have responded miraculously to parathyroid therapy, for practically all the cases thus treated have been 'wet' for a number of years." I agree with Harrower that the cure of chronic otitis media and of chronic sinusitis with parathyroid feeding would be nothing short of miraculous, but are we ready to go back to the age of miracles?

Novak and Hollender[3] have reported a study on the effects of calcium lactate and thyroid extract treatment of hay-fever, asthma and hyperesthetic rhinitis. They claim that the calcium content of the blood is frequently low in such patients. These observers report no improvement from administration of calcium lactate alone. Calcium lactate plus thyroid extract is said to produce temporary relief. Calcium lactate plus thyroid extract plus mercury vapor quartz light is said to produce more permanent relief. Without questioning the clinical findings, I must remark that reliable data on blood calcium are difficult to secure; that the relation of the parathyroids or the thyroids to the blood calcium or to general calcium metabolism is still unsettled; that the evidence for hypothyroidism or hypoparathyroidism as a causative factor in rhinitis, hay-fever and asthma is as yet extremely doubtful. It is true that one of the early symptoms of parathyroid deficiency or parathyroid tetany in dogs is irritation of the nasal mucous membrane and repeated sneezing. This may suggest hay-fever and rhinitis. I am inclined to ascribe these nasal and respiratory parathyroid deficiency symptoms in dogs as due to vascular changes in the mucous membranes secondary to the disturbance in the irritability of motor and sensory nerves. Moreover, these nasal and respiratory symptoms accompanying parathyroid tetany in dogs are quickly and completely controlled by oral administration of large doses of calcium lactate.

THE THYROID

We come now to the most important and at the same time most difficult field in the possible relation of endocrine glands to disorders of the ear, nose and throat. There is today ample evidence that the thyroid hormone influences the metabolism of practically every cell in the body, directly or indirectly, so that when we have sufficient hypofunction of the thyroids we have general metabolic impairment of the tissues. This results in cretinism in the young and myxedema in the adult, with attendant disorders of growth, mentality, sex, etc. Now it would seem *a priori* probably that a hormone like the thyreoglobulin which has such

3. Novak, Frank J., and Hollender, A. R.: Influence of Ultraviolet Irradiation on Calcium Content of Blood Serum, J. A. M. A. **81**:2003 (Dec. 15) 1922.

far-reaching effects should also influence the tissues of the ear, nose and throat and that failure or diminution of this hormone in the body might produce serious disturbances in the field of your specialty. Now, just what are the facts? On the experimental side these may be summed up as follows:

Complete removal of the thyroid in young but otherwise healthy animals produces cretinism. Complete removal of the thyroids in the adult but otherwise healthy animal will lower the metabolism, but will not necessarily produce the myxedema characteristic of man, but neither in experimental cretins nor in thyroidectomized adult animals do we necessarily have deafness, adenoids, hyperplasia of the tonsils, intumescence, epistaxis, otitis media, mastoiditis, otosclerosis, or any of the other recognized and definitely described diseases of the ear, nose and throat. It is, however, true that in experimental cretin animals there is decreased resistance to infection and to that extent hypothyroidism may favor ear, nose and throat infection, and to that extent the feeding of thyroid may, by increasing the resistance to infection, tend to ward off or diminish such infections of the ear, nose and throat.

With this statement of the experimental facts, what are the facts in man? We are aware that in some regions of the world cretinism and myxedema are endemic. In these regions, obviously, a good percentage of the ear, nose and throat ailments will occur also in cretin and myxedematous persons. In fact, that is to be expected even in cases of sporadic cretinism and myxedema in our own country. The question is, are such infections or other disturbances of the ear, nose and throat of a higher incidence in cretins or myxedematous persons than in the rest of the population of the community? Evidence for causal relation of hypothyroidism to ear, nose and throat infections may also be gathered indirectly by seeing to what extent such ear, nose and throat pathology can be favorably influenced by thyroid feeding since we know that hypothyroidism can be largely overcome by suitable thyroid organotherapy.

Falta may be quoted on this point: "The statements as to disturbances of hearing in sporadic cretinism are very diverse. The assumptions as to the cause of these diverge greatly. It is certain that the absence or insufficiency of the thyroid may lead to disturbances of hearing. I refer to the results of thyroid medication that are often obtained in a striking manner in these cases. It is just as certain, however, that with complete failure of the thyroid gland the organ of hearing may be completely developed from birth on. Hence what is under dispute is only how to explain the disturbances that occur in some cases." Then Falta goes on to recite the various theories that have been advanced, such as myxedematous swelling of the mucous membrane of the tympanum, the eustachian tube, etc. I again quote:

"There remains, however, the circumstance that in complete absence of the thyroid gland from birth, deafness does not always develop, and we have patients with true thyroaplasia, that is, complete absence of the thyroid, who have normal hearing." "Also I should not neglect to mention that in the numerous dogs on which I myself performed thyroidectomy, and on which later exact investigation disproved any existence of accessory thyroids, perceptible mutism were never to be observed even after a period of observation lasting up to two years. The question still needs careful study." These observations of Falta on hearing in thyroidectomized dogs are corroborated by the observations of Luckhardt and Dragstedt in our own laboratory. We have had completely thyroidectomized dogs in our laboratory, at least fifty of them, for periods varying from a few months to two years after operation, with no evidence of failure of hearing or development of any other abnormalities of the ear, nose and throat.

In a recent paper by Schatz, reference is made to the report in the literature of epistaxis and bleeding of the gums as being frequent in cretinism and myxedema. In endemic cretinism in various countries the percentage of deafness is sometimes given as high as 87 per cent. (McCarrison). In some cases this seems to be due to developmental defects of the internal ear. Other writers have ascribed asthma, rhinitis, catarrh, etc., to hypothyroidism. Enlargement of the tonsils and adenoids have also been ascribed to hypothyroidism while headaches and migraine with ear noises have by some been associated with hyperthyroidism or exophthalmic goiter.

Harrower both manufactures and recommends—naturally—such things as "adrenopituitary compounds," and "pancreatin bile compounds" in the treatment of asthma. He also speaks of the "condiment influence of the thyroid gland," and adds: "A pluriglandular formula that has some thyroid in it is very much more efficient therapeutically than when no such addition is made!"

Wilson [4] states that treatment with lymph glands will in most cases reduce to normal size chronic enlarged tonsils and adenoids. The same author finds a combination of lymph glands and thyroid extract also effective in enlarged tonsils and adenoids. Well, lymph glands are plentiful and cheap; enlarged adenoids and tonsils are not uncommon; it should not take long to prove or disprove the curative value of a lymph gland diet in these disorders.

Sajous conjectures that the deafness of old age is caused by thyroid and suprarenal insufficiency. Callion has suggested that progressive deafness is due to combined hypofunction of the thyroids and testes. Schatz thinks that the thyroids and suprarenals are also involved. Thus

4. Wilson, S. M.: New York M. J. **117**:425, 1923.

by a series of guesses the basis is laid for pluriglandular organotherapy for deafness. Schatz reports a cure of tinnitus due to middle ear catarrh, as well as a cure for chronic discharging sinusitis by the feeding of thyroid extract. This is within the range of the possible, although I believe that unless the hypothyroidism in the patient is sufficiently marked to cause distinct symptoms of myxedema or cretinism the resistance to infection in the ear, nose and throat would not be sufficiently altered so that the disease would be positively influenced by thyroid feeding. However, it is possible that even if the thyroids were functioning normally the temporary stimulation of the general metabolism by thyroid feeding might have a favorable effect on ear, nose and throat infection.

COMMENT

So far as we can see at present, the thyroid is the only endocrine gland and the only field of organotherapy that calls for a serious survey and investigation from the point of view of possible relations to the infectious diseases of the ear, nose and throat, even in cases where distinct cretinism and myxedema is absent.

Thirty years of patient research, experimental and clinical, has given us thyreoiodin, thyroxin and insulin. And in the case of the glands where the hormones have so far eluded isolation, honest and patient research has added much to our knowledge of their relations to health and disease. On the other side of the ledger we have even more numerous entries of wild guessing, uncritical empiricism, post hoc reasoning and blatant humbug. Thus it has come about that the serious worker in this field is facing not only the difficulties inherent in a fundamental and complex phase of the life processes, but his vision is obscured by the dense fog of pseudo scientific and pseudo medical literature. The age of reason seems as far away as the millenium. Organotherapy is being jazzed, to the confusion of many honest doctors. It is literally true that extracts of every tissue in the body has been used to cure every known disease. And the success of such therapy is attested by the "crucible" of some kind of a clinic. One has just to glance at the testimonials. Nothing seems easier than to elaborate new cures for human ills. But, nevertheless, we all die, and the historian adds chapter after chapter on the "cures that failed." The best thing under the circumstances is to ignore the jazz and proceed with our work. Perhaps we should add to our program "the endocrine aspect" of credulity, mendacity and plain bluff. Or what about "electronization" of the frontal lobes of the cerebrum for some of this mental and ethical imbalance? Perhaps a little brain extract might do wonders, especially if we went to the horse rather than to the sheep for the raw material, and more especially if we shared these brain tablets with our patients on the half and half basis.

THE TECHNIC OF OPERATIONS FOR ABSCESS OF THE BRAIN*

CHARLES A. ELSBERG, M.D.
NEW YORK

There is still considerable difference of opinion as to the best technic to be followed, on the part of those who are called on to perform operations for abscess within the brain substance.

The otologist, who so often encounters intracranial suppuration as a complication of middle ear disease, usually, and I believe often inadvisably, makes the approach to the abscess by an extension of the incision of the mastoid operation, whether it is in a cerebellar hemisphere or in a temporal lobe. The surgeon, on the other hand, is more likely to expose the brain and to deal with the abscess through a separate opening in an aseptic field, well away from the wound of a former operation if such has been performed.

I shall not give the results of my operations for brain abscess, for in such a report the classifications of the patients would have to be considered, and the varying location of the collection of pus. The problem is entirely different if an abscess is superficial and extends up to or into the cortex, than if it lies in the depth of from 3 to 4 cm. below the surface of the brain. After operation, the outlook varies also with the different etiology of the intracranial suppuration.

From a study of the conditions found at operation and at necropsy, I have become convinced of two facts, first, that in the large majority of those who recover after the drainage of a brain abscess, the abscess had a more or less thick lining membrane, which walled off the area of suppuration from the surrounding brain tissue, and second, that the high mortality in brain abscess is due to the fact that so many of the abscesses have no limiting membrane, but the walls of the abscess cavity are formed by infected and sloughing brain tissue. When the walls of the abscess consist of infected and degenerating brain tissue, more and more tissue becomes involved, and the sloughing is inclined to continue with the formation of secondary abscesses or invasion of a ventricle. There are, therefore, the two types of abscess of the brain: the one with a lining membrane which may be very thin or several millimeters in thickness, and the abscess without a lining mem-

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* Read before the Section on Laryngology, Otology and Rhinology at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.

brane. Not only the chronic abscess but also an acute area of suppuration may early be surrounded by such a lining wall, which may be very thin and tenuous but which still isolates the pus from the surrounding brain tissue. It is true that the acute abscess without a lining wall is more certain to be one which contains living virulent organisms, while the pus from the chronic form is more often sterile or contains organisms of only a low degree of virulence.

The acute abscesses in the temporal lobe which so often complicate middle ear disease, no matter whether they contain virulent organisms or not, often have such a lining membrane. The acute cerebellar abscess, on the other hand, rarely has a definite abscess wall. The abscess of long standing, however, whether in a temporal or in a cerebellar lobe, usually has such a lining membrane. In the abscess which occurs as a complication of frontal or ethmoid sinus disease, a distinct abscess wall is often present, while in the acute intracranial suppuration that follows infection within the orbit, the abscess, generally in the homolateral frontal lobe, is usually without any lining membrane.

Abscess secondary to osteomyelitis of the cranial bones and that which occurs as a complication of injuries to the skull and brain present a much simpler problem, for these abscesses are usually superficial, lie just beneath the cortex and usually have a distinct limiting wall.

Abscess of the brain secondary to pulmonary suppuration or in the course of a bacterial invasion of the blood stream rarely, if ever, has such a lining and limiting wall, and in addition, these abscesses are usually multiple, and either grossly or microscopically, in addition to the main abscess, numerous smaller foci of suppuration are found in the brain.

As soon as the diagnosis of brain abscess has been made, the indications for operative interference are clear, unless there is already a meningeal inflammation with the presence of organisms in the cerebrospinal fluid. The error to refuse to operate should not be made when the patient already shows some signs of meningitis, namely, some rigidity of the neck and some flexor spasm at the knees (Kernig). In some patients these signs indicate a meningeal irritation rather than a true spreading meningitis, and the differentiation must be made by means of lumbar puncture and immediate examination of the fluid obtained. If there is no increase of cells, or if the increase consists mainly of lymphocytes, there is no contraindication to the opening and drainage of the abscess. If, however, the fluid is turbid with a large number of polymorphonuclear cells and with bacteria on cultures, the

meningeal infection is, in the majority of instances, so far advanced that the opening and drainage of the abscess will seldom, if ever, prevent the spreading meningeal infection and a fatal outcome.[1]

METHOD

Except in children, the operation for intracranial suppuration should, unless in delirious and restless patients, always be performed under local anesthesia, and by means of a proper injection the surgical procedures can be carried out without causing pain. The area in which the scalp is to be incised should be anesthetized with the chosen local anesthetic the same way as for other cranial operations. If the localization of the abscess is definite, the incision in the soft parts and the opening in the bone should be made in a location in which the least injury can occur to important areas of the brain, and in the location which is most favorable for drainage. Thus, the line of approach to a frontal lobe abscess should be from the side rather than from in front, and the approach to a cerebellar abscess should be from behind rather than from the side. The approach to an area of suppuration in a temporal lobe, which is of especial interest to otologists, should be well in front of the line of the Rolandic area or if the symptoms are more parietal, then well behind and above the area of the operation on the mastoid. Figures 1 to 8 illustrate the various steps of the operative procedure, but there are several guiding rules to be especially mentioned.

1. The first opening in the bone should always be as small as possible. An opening made with a trephine and enlarged with rongeurs until it measures about 3 by 4 cm. is sufficient in most instances. An osteoplastic bone flap should never be made. If, as I shall describe later, the abscess is found to be one without a lining membrane so that its treatment has to be different, more bone can be rongeured away without difficulty. As small an opening as possible in the bone for the drainage of a walled off abscess is of advantage not only from the standpoint of the defect in the skull that will remain, but it will also prevent a large herniation of brain tissue. This is one of the reasons why I believe that, whenever possible, a separate incision in the scalp and a separate opening in the bone should be made for the temporal or cerebellar abscess which complicates disease of the middle ear and mastoid which has already been subjected to surgery.

2. The incision in the dura should always be a liberal one and should be almost as long as the bone defect.

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1. This statement has, of course, no reference to the difficulties of diagnosis, so often encountered between the early symptoms of meningitis and of a brain abscess.

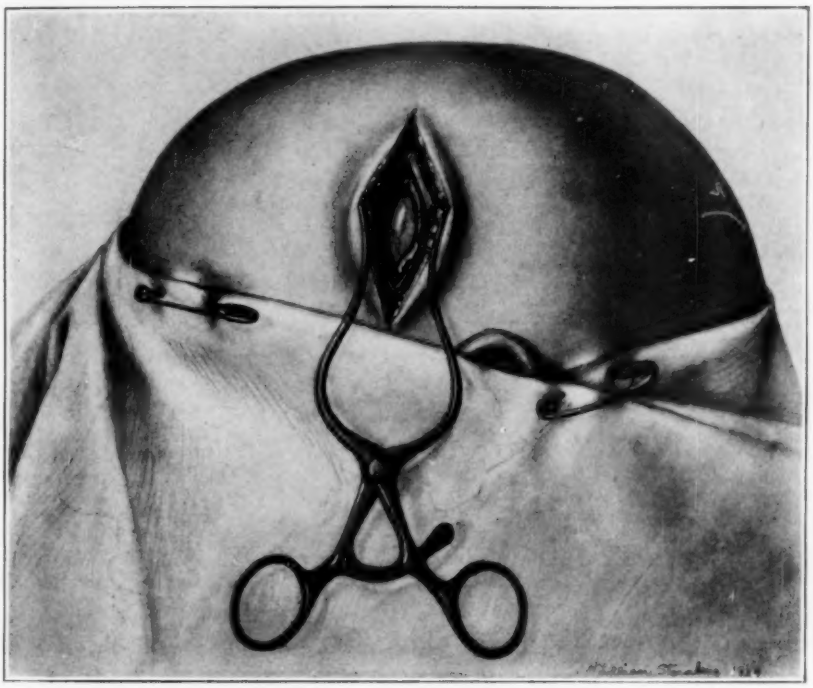

Fig. 1.—The manner of draping the head, and the automatic retractor in place after the primary bone defect has been made.

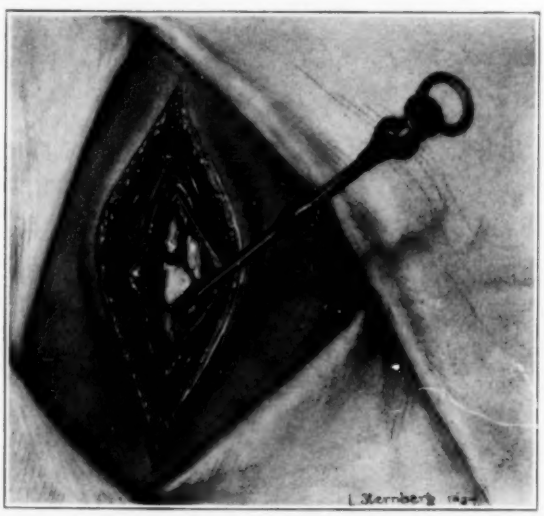

Fig. 2.—The dura incised and the needle (with stilet) in the abscess cavity.

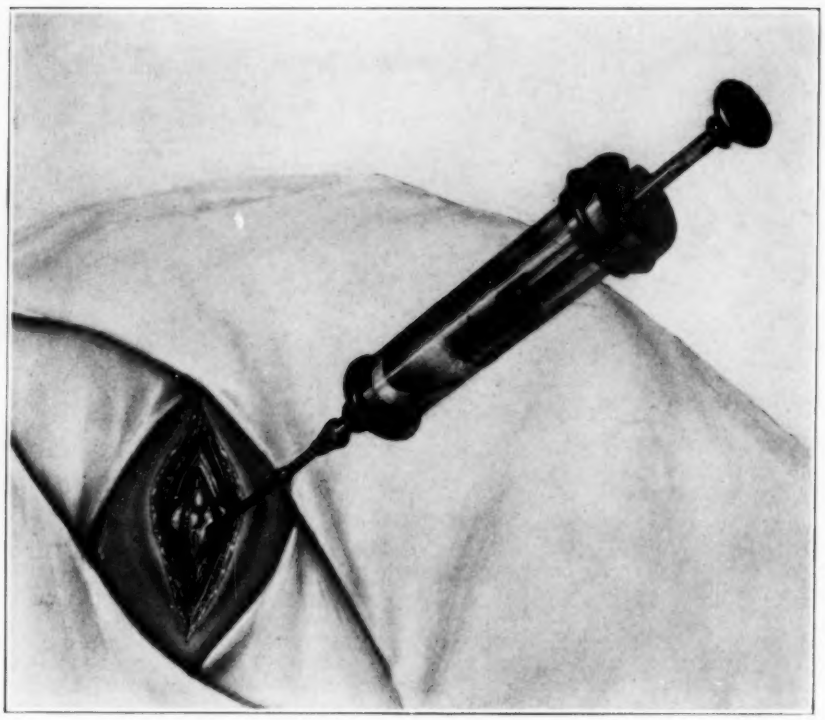

Fig. 3.—A small quantity of pus drawn into the syringe.

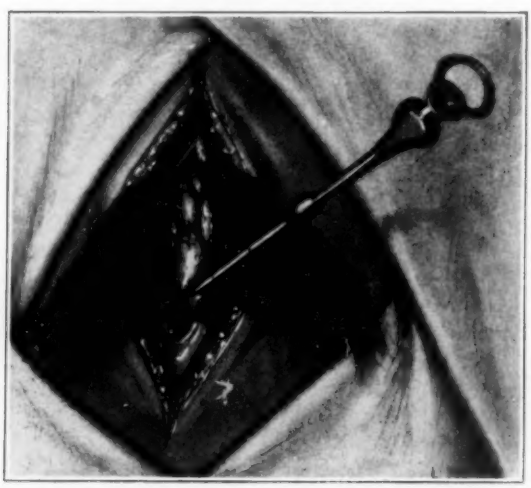

Fig. 4.—The syringe removed and the stilet reinserted. The iodin gauze packings inserted.

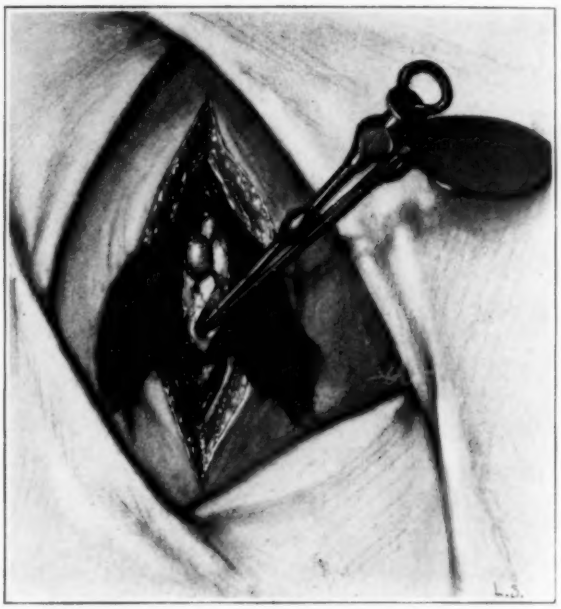

Fig. 5.—The grooved director inserted with the needle and to the same depth. (Note that both needle and director are marked in centimeters.)

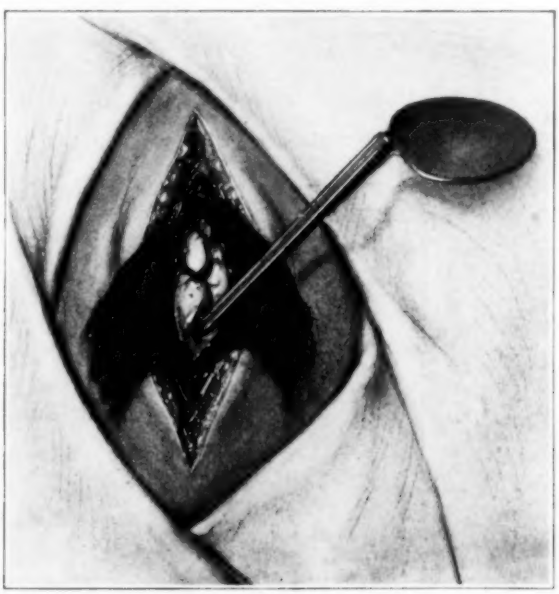

Fig. 6.—The needle removed and the grooved director still in place.

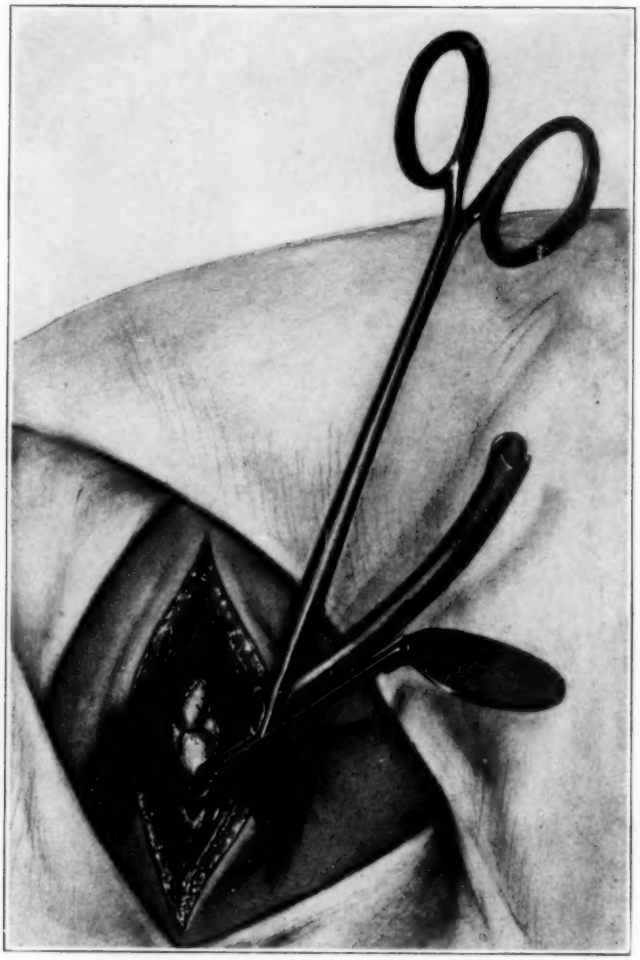

Fig. 7.—The introduction of the drainage tube which is split at the outer end.

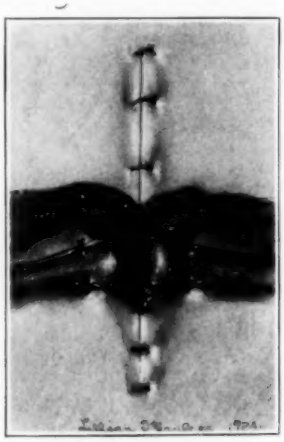

Fig. 8.—The drainage tube sutured into place and the wound closed.

3. The aspiration of the brain should never be made with a sharp needle but always with a needle with a rounded end (Fig. 9), so that when the puncture is made, the resistance of the abscess wall, if such a wall exists, can be plainly felt.

4. When the needle has entered the abscess cavity, only a little pus should be withdrawn or allowed to escape, as it is important to have a more or less distended abscess cavity for the further manipulations. A culture of the pus should be made at once by an assistant, and on a smear, the presence or absence of organisms determined.

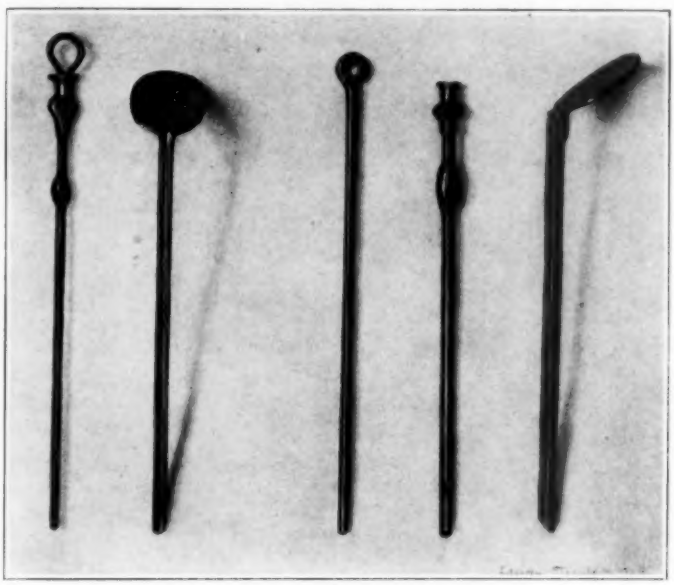

Fig. 9.—The needles used for aspiration and the grooved directors to fit each size of needle. (Note that the needles have rounded ends, that the groove on each director runs to the tip, and that both needles and directors are marked in centimeters.)

5. The exploring needle should remain in place as soon as the pus has been located, and the meninges protected against infection by means of small strips of gauze soaked in tincture of iodin and packed between the dura and the brain on all sides, so as to wall off the area of operation from the surrounding meninges. In this connection, I should like to say that it is my belief that meningitis due to the opening of a brain abscess should rarely, if ever, occur if this part of the operative procedure is properly carried out.

6. The steps of the procedure, from the puncture with the exploring needle to the introduction of the drainage tube, are illustrated in the

figures. I prefer a large rigid drainage tube of soft rubber which is split at the emerging end and is fixed to the scalp on both sides by several silk sutures. This fixation of the tube is very important, for it prevents the tube being partly pulled out and then again pushed in when the dressings are changed. With the tube fixed in the manner shown in Figure 8, the dressings can be changed as often as necessary without the tube being in any way disturbed.

7. The drainage tube should never be removed but should remain in place for a number of weeks, until all drainage of pus has ceased. It is incorrect to withdraw the drainage tube after a week or two and then reinsert it. When the drainage has ceased, the tube should

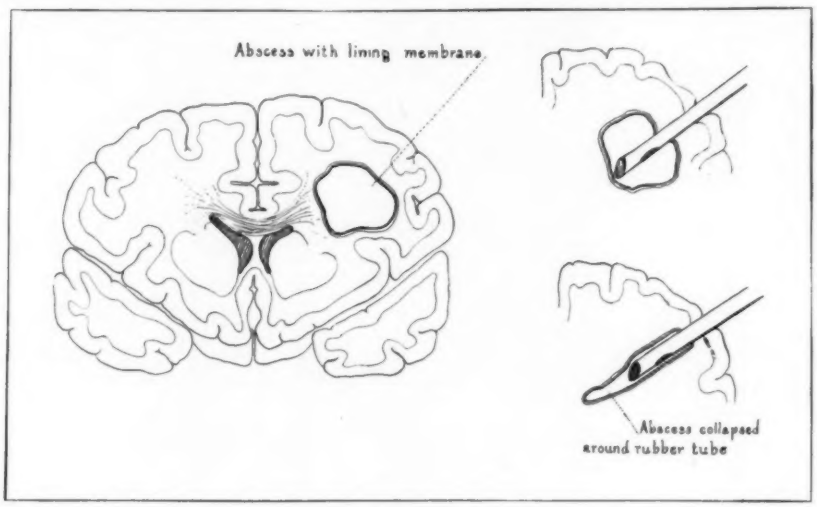

Fig. 10.—An abscess with a lining membrane, showing the manner in which the abscess wall falls around the drainage tube (diagramatic).

be gradually shortened, until it is entirely removed. I have frequently left a drainage tube in place undisturbed for from three to six weeks and sometimes even longer.

8. Hernia of the brain cannot always be avoided after the opening and drainage of a brain abscess without a lining wall; it is sometimes of advantage, but the persistence of such a hernia means that infection of the subjacent brain persists. If no infection remains, the hernia will usually shrink rapidly and its granulating surface become epidermized within a short time. Occasionally, a bulging of the brain will remain for a time, owing to a moderate degree of distension of the ventricles with fluid, and this type of herniation of the brain will temporarily at least, recede after the withdrawal of fluid by lumbar puncture.

So far, all reference has been to the technical procedure to be followed in the drainage of an abscess with a lining membrane (Fig. 10). In such an abscess the limiting wall will collapse around

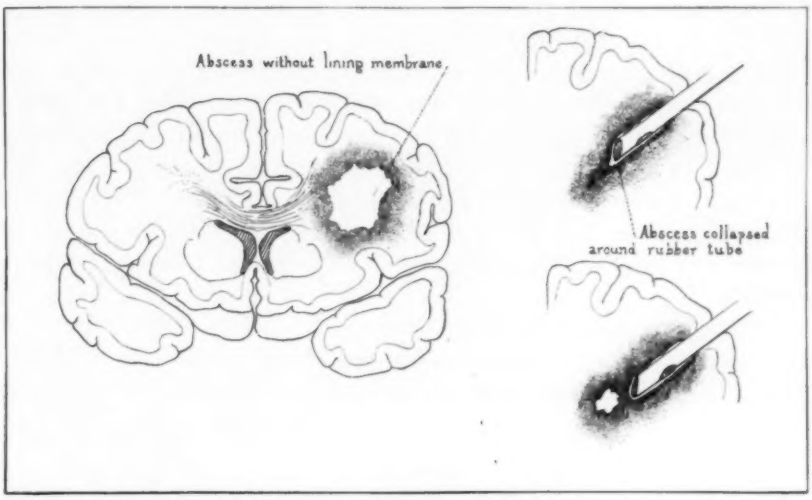

Fig. 11.—An abscess without a lining membrane, the walls formed by infected brain tissue. Secondary abscesses often occur.

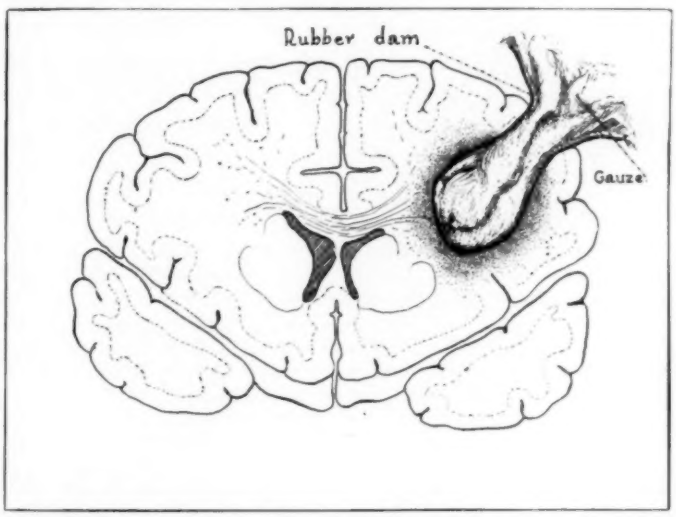

Fig. 12.—The draining of an abscess without a lining wall, after wide incision into the abscess cavity.

the tube, but drainage conditions will be satisfactory and as soon as all the pus has been drained off and the infection has been relieved, granulations will spring up on the inner surface of the limiting wall until the cavity has been obliterated.

In an abscess without a limiting wall, however (Fig. 11), the drainage conditions are always imperfect, for the soft infected brain tissue collapses around the tube and secondary abscesses are formed in infected brain tissue which lies beyond the end of the drainage tube.

In these patients, therefore, and in all in whom it is uncertain whether there is a limiting wall to the abscess, I have recently done an entirely different operation. As soon as the pus has been found with the exploring needle, and while the needle is still in place, the opening in the bony skull is enlarged with rongeur forceps until a large opening in the skull, measurnig about 5 by 6 cm., has been made. The dura is widely opened and iodin gauze packings are inserted all around. An incision, from 3 to 5 cm. in length, is then made in the cortex, and is carefully deepened until the abscess cavity has been exposed and opened.

Instead of using a tube for drainage, a piece of rubber dam with gauze strips packed into it is inserted into the abscess cavity (Fig. 12), thus forming a Mikulicz tampon, which keeps the abscess cavity wide open.

COMMENT

With this radical change in the treatment of abscesses without a lining membrane, I have seen patients recover, in whom hitherto, a progressive involvement of brain tissue and a fatal outcome had not been prevented. My experience is as yet too small to say more than that I believe this to be the proper treatment for that form of abscess of the brain that is without a lining membrane, a form in which recovery after operation has been a rare occurrence in the past.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. ELSBERG AND KING

Dr. John F. Barnhill, Indianapolis: I wish to say a few words concerning the drainage plan. I dislike to disagree with one who has had the experience of Dr. Elsberg. Nevertheless, if we do not report that which we personally see and fully believe, especially when based on actual experience, progress may lag. All the patients with brain abscess that I have ever had that recovered, I speak of those of otitic origin, have been drained through the mastoid wound. All the patients I have had that died were cases in which I drained by an opening through the squama above the mastoid wound, and without any connection with the mastoid wound. It seems to me that there is good reason for such a result, for if we do not drain through the mastoid wound, we disobey the first principle of surgery, namely, to drain from the bottom. A disease that is of otitic origin has entered the brain through the tegmen antri, or posteriorly toward the cerebellum and it is wise, in either case, to follow the path of its entrance. This has been the rule of both European and American authorities, for in chronic cases it has been proved that there is a tract of tissue leading from the source in the mastoid to the abscess, and this so-called stalk ought in every case to be followed. By doing so the surgeon traverses the exact route taken by the disease, and enters the abscess at the point of greatest surgical advantage.

DR. CHARLES A. ELSBERG, New York: With reference to what Dr. Barnhill has just said, it has very rarely been my experience to find stalks leading from the disease into the brain. In a large majority of instances, there has been no apparent communication between the disease outside and the disease within the brain itself, and in all I said I referred to the abscesses that lie deep within the brain. I take it that these are the ones which present the real problems, much greater than those to which Dr. King referred, and for which he has devised a method which seems to offer much. This type of abscess lies from 3 to 5 cm. beneath the surface of the brain; these are the ones which present the great problem in the surgery of brain abscess. In these abscesses I do not know that I have ever seen a direct communication between the disease on the surface, whether it is in the meninges or in the mastoid, and the abscess in the brain itself. I know they occur, but in my experience they are rare, indeed.

THE TREATMENT OF BRAIN ABSCESS

A SURGICAL TECHNIC IN WHICH THE USUAL DRAINAGE METHODS ARE AVOIDED *

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In November, 1923, I [1] described an operation for brain abscess, and gave a report of three patients operated on in this manner. As this paper has not been published, the method described will be reviewed. In addition, a patient operated on by this method, although suffering from traumatic abscess with sinus formation, which in reality should not be classified as a true brain abscess, will be reported.

Heretofore, results following operation for brain abscess on the whole have been poor; the mortality rate has been so high that no operative procedure which has been followed by various operators has been considered adequate to cope effectually with the situation. Bagley [2] in a paper which was read a year ago, stated the following:

> The serious state of patients when presented for treatment, the difficulty in making decisions concerning operations, and the high mortality rate in reported cases all indicate a lack of precision which we should endeavor to overcome. . . . Gradually increasing interest in surgical conditions of the nervous system has exerted a good influence, but a review of the literature and a survey of one's clinical experience force the admission that our cures of brain abscess today, like the cures twenty-five years ago, are more or less accidental, and in many cases merely a question of luck.
>
> In spite of the fact that the cerebral function may be entirely restored and there need be no recurrence of the lesion . . . this malady is feared, and the patient and physician often abandon hope at the first sign of involvement. The present dread of the condition seems justified when we consider that the mortality rate in a series published in 1922 was 75 per cent.

Eagleton [3] in a recent discussion as well as in his monograph, said that it was his belief that if all cases of brain abscess were reported with the results, the recovery precentage would not be higher than 25 per cent. He said that such was his experience.

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* Read before the Section on Laryngology, Otology and Rhinology at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.

1. King, Joseph E. J.: The Treatment of Brain Abscess by Unroofing and Temporary Herniation of Abscess Cavity with the Avoidance of Usual Drainage Methods, with Notes on the Management of Hernia Cerebri in General. Read before the New England Otological and Laryngological Society, Boston, Nov. 27, 1923.

2. Bagley, Charles: Brain Abscess, J. A. M. A. **81**:2161-2166 (Dec. 29) 1923.

3. Eagleton, Wells, P.: Brain Abscess, New York, The MacMillan Company, 1922.

Formerly, operators in the procedures for the relief of brain abscess, have for the most part depended on localization of the abscess and drainage of the contents of the abscess cavity with some type of drain brought out through a rather small trephine opening in the skull. Various kinds of drainage materials have been devised and used, among which are rubber tubes, rubber tissue, strips of rubber dam, glass tubes, gauze packing, wire mesh tubes, conical shaped wire mesh drains, metal searchers and several other kinds. Isolated cases of recovery following the use of practically every type of drain have been reported, but no high recovery rate has been reported with the use of any one type of drain. In the majority of cases with fatal termination, death has resulted from extension of the infection from about the site of operation, from rupture of the abscess into the ventricle, formation of "secondary" abscess pockets which rupture into the ventricle, etc. Frequently the drain is displaced and in an attempt to reinsert it, it has been found that in a number of fatal cases the drain was not in the original tract but was found to be in the brain substance itself.

The difficulties met with in the use of drainage materials are too numerous to describe in this paper; suffice it to say that no type of drain with which I am acquainted really "drains," in the sense that the abscess cavity is completely and permanently obliterated and a series of cases can be reported with a high recovery rate.

I believe the experience is not uncommon, that following the drainage of an abscess one will observe that the patient's condition improves and this improvement may last over a considerable period of time, and the patient may even be discharged from the hospital as recovered, when after a interval of time ranging from a few weeks to months, there will be a sudden collapse followed by death; such as has been my experience in the past.

In 1920, at the New York Eye and Ear Infirmary, on the invitation of Drs. John McCoy and Stuart L. Craig, I operated on a patient with an encapsulated temporosphenoidal lobe abscess, following a simple mastoidectomy. During the exposure for drainage of the abscess, a cranial defect about the size of a half dollar was made. The abscess was entered through a rather large crucial incision in the dura, and drained through a tract about the size of one's thumb leading into the abscess cavity, a rubber tube about 0.5 inch in diameter, and four strips of narrow gauze packing being used as drainage material. This patient's condition improved immediately following the operation.

The treatment consisted only of frequent dressings, with irrigation of the abscess cavity and operative area with surgical solution of chlorinated soda. After several days, it was observed that herniation of

the brain was taking place. It was necessary to shorten the drainage tube, as it was being extruded owing to the abscess cavity becoming more shallow, and it was feared that the pressure of the dressing might force the drainage tube into the ventricle. A few days later the abscess cavity could not retain the tube, therefore it was removed and discarded. The hernia completely receded with no other treatment than irrigation with the surgical solution of chlorinated soda. The patient recovered and is well at the present time. In this instance, herniation was not desired or expected; it occurred with eversion of the abscess cavity and with no other treatment than dakinization. The patient made a complete recovery which was considered by us at the time to be a "lucky accident."

About three weeks later, I operated on another temporosphenoidal lobe abscess, practically identical in location, shape, size and encapsulation as the one described in the foregoing. In this instance, however, I drained the abscess through a small trephine opening which had, as I thought at the time, luckily been made directly over the abscess cavity. The drainage employed was as before described. No herniation took place in this case as the trephine opening was so small that it could not occur. The patient improved, was able to be up and about the hospital grounds, but subsequently died of rupture of a secondary pocket into the ventricle.

A few months later I operated on a frontal lobe abscess in a similar manner. This patient likewise, after an interval of improvement, died following rupture of the abscess into the ventricle.

After having had this experience, I considered closely the questions of drainage and the desirability or undesirability of temporary herniation of the brain. In the first patient, evacuation of the abscess cavity had been accomplished through a rather large trephine opening, through which a hernia cerebri subsequently occurred followed by recovery of the patient. In the other two patients, similar drainage had been instituted through smaller trephine openings in which herniation did not occur; both patients died.

Other cases have been reported in which recovery took place following herniation at the site of drainage of the abscess cavity. Eagleton [3] reported a case in his monograph with photographs showing the hernia after operation, and the patient three years after the evacuation of the abscess with: "recession of hernia and its complete covering by skin without operative intervention or the application of pressure." It is also well known that during the world war that of a number of patients with severe gun shot injuries of the head in which the brain was severely damaged, several recovered following removal of a large mosaic of fragments of skull followed by herniation of the brain. Many of these

patients were later seen by us in the neurosurgical services in hospitals here. We have had patients with compound depressed fractures of the skull in Bellevue Hospital, in which the wound were infected and suppuration occurred followed by the development of hernia cerebri. The hernia receded with no other treatment than protective dressings and irrigation with the solution of the wound. The question then arose in my mind: why not, at the time of the original operation, provide a rather large trephine opening or cranial defect directly over the site of the abscess, pack off the subdural and subarachnoid spaces to prevent extension of infection; "unroof" the abscess cavity by completely removing the overlying brain substance; completely empty the remaining portion of the abscess cavity by irrigation with surgical solution of chlorinated soda; allow temporary herniation of the brain to take place through the cranial defect produced, with eversion of the abscess cavity, so that no drainage with drainage materials will be required; and let the subsequent treatment consist of irrigation of the area with surgical solution of chlorinated soda and prevention of trauma to, and early compression of, the hernia by protective dressings, followed by recession of the hernia and epithelialization of the wound? I came to the conclusion that this was the proper procedure, and that patients which would come under my observation thereafter would be treated in such manner.

Three patients with true brain abscess, and one with an abscess about a foreign body in the frontoparietal region, communicating with a subcutaneous pus pocket, which was the result of a gunshot wound of the head, have been consecutively operated on by me in this manner; all have recovered and are well and self-supporting today.

On observations made in these four cases, the conclusions have been arrived at and stated in this paper. The etiology, pathology, symptomatology and diagnosis of brain abscess will not be discussed, as the literature is replete with papers on these phases of the subject.

A detailed description of the operation proposed, suggestions in the after care of the patient and report of the three original cases in full were written in the original paper read last year. This paper in its entirety will be published soon. At present, only a brief review will be given.

TECHNIC OF OPERATION

Local anesthesia was the process chosen. Sometimes the patient will be in such a stuporous or semicomatose condition, that little, if any anesthetic will be required.

The preferred incision is three limbed in the case of temporosphenoidal lobe abscess; otherwise a crucial incision is preferred. The incision is carried down to the outer table of the skull and the three or

four flaps consisting of all the soft parts are elevated, reflected and are held with self retaining cranial retractors. The angulated retractors which were first used in Frazier's clinic are preferred. These give adequate exposure and prevent bleeding. No artery clamps will be required. The apexes of the flaps are turned backward and sutured with one suture to the base of the flap. A trephine opening is made directly over the suspected site of the abscess with a Hudson cone drill. A small incision in the dura about 0.2 inch long is made for the purpose of exploratory puncture. Adhesions may be found obliterating the subarachnoid and subdural spaces; if not, and if an abscess is present, in the majority of cases the underlying cortex will bulge through the small incision, thus closing off these spaces; therefore, whether adhesions are present or not, these spaces will be closed off during the puncture. In addition, throughout the procedure, the wound is continually sponged out or irrigated with a surgical solution of chlorinated soda. The chances of extension of infection into the meninges are thus reduced to a minimum. When pus is obtained, the depth at which the abscess is entered is noted, a specimen is preserved for the laboratory and the cannula is withdrawn. The trephine opening is then enlarged circularly with rongeurs, to the approximate size of a half dollar or larger. This enlarged opening in the skull should be placed directly over the abscess cavity. After the definite extent of the abscess cavity has been determined, the cranial defect thus created may have to be altered in shape so that its position will be directly over the abscess.

The dura is then incised in a stellate fashion, thus forming six pennant-shaped dural flaps. These are turned back over the bony margin of the cranial defect and loosely sutured with one suture of fine plain catgut to the under surface of the pericranium which forms a part of the reflected soft part flaps. Three pieces of 0.2 inch iodoform gauze are "insinuated" in a concentric manner between the cortex and the dura, to wall off the subdural and subarachnoid spaces to prevent extension of infection. The ends of the three pieces of gauze should be left about 0.7 inch long, so that their removal at a later date can be accomplished more easily.

The abscess cavity is again entered with the exploring cannula to verify the position of the abscess, and along the cannula a sharp pointed knife is inserted and an incision about 0.2 or 0.5 inch long is made through the brain substance overlying the abscess and the capsule, if one is present. The contents of the abscess cavity is then aspirated with a soft rubber catheter and syringe, so as to prevent gross soiling of the field of operation, after which the cavity is repeatedly filled with surgical solution of chlorinated soda and aspirated until the return fluid

is fairly clear. The incision through the brain substance is then carried with a sharp knife to the limit of the abscess on one side, after which it is carried in a circular direction through the brain substance and capsule, if one is present, completely around the abscess. The overlying brain tissue and capsule thus removed by the circular incision, is discarded, so that the abscess cavity is completely "unroofed." The cavity is then inspected and the remaining contents, if any, are removed by irrigation with surgical solution of chlorinated soda and gentle sponging. A complete "cleansing" of the cavity is more easily accomplished in encapsulated than in nonencapsulated abscesses. No exploration is made with the finger or instruments; it is not necessary as a thorough inspection can be made if the abscess is completely unroofed as advised; the capsule, if present, is not removed. During the inspection and cleansing of the abscess cavity, it will be observed that its depth will become more shallow, the remaining portion of the cavity less concave and the floor of the cavity appreciably rise; in other words, herniation tending toward eversion of the cavity will commence during the operation. In the light of past experience, this condition obviously predicts what should and what will take place.

No drainage tubes or other drainage materials are inserted into this remaining portion of the abscess cavity. A fenestrated rubber dam is placed over the cavity, over which small pieces of gauze soaked in surgical solution of chlorinated soda are placed. The original three pieces of iodoform gauze which were placed around the dural opening are not removed or changed. These pieces, during the procedure, adapt themselves into the margin of the subdural space and tend to prevent leakage into the subdural and subarachnoid spaces better than if they were changed and new ones introduced.

The intention of the procedure, is, first, to remove the contents of the abscess cavity, and second, to remove the roof of the cavity so as to allow the remaining portion of the cavity to herniate outward through a cranial defect which is intentionally placed directly over the abscess. The rubber dam is used to protect the surface of the after-forming brain hernia, it offers better protection than gauze or any other substance which might be used, because there is no trauma to the hernia in its removal, and it allows irrigation with the solution of the shallowing abscess cavity on account of its being fenestrated. The rubber dam is then covered with a piece of gauze, moistened in surgical solution of chlorinated soda, three perforated Dakin tubes are then placed over the gauze, so that afterward the entire area will be kept thoroughly wet with the solution, and a copious wet gauze dressing consisting of flats and headroll is applied. Both ears are covered with several layers of

petrolatum gauze to prevent irritation by the solution. If the abscess is frontal in location, it is advisable to cover one or both eyes with the gauze and include them in the dressing. Petrolatum gauze is not applied to the scalp surrounding the wound until the first dressing on the following day, as the scalp will withstand irrigation with the solution for twenty-four hours without irritation. The entire dressing is held in place with wet gauze bandages, including the head and the lower jaw, so as to prevent removal or displacement of the dressings by the patient.

This procedure is equally applicable for the treatment of abscesses whether located in the frontal or temporosphenoidal lobes (with or without extension into the parietal or occipital lobes), or cerebellar regions, or for those abscesses which are secondary to an old infected depressed fracture or osteomyelitis. These groups form the greater majority of all brain abscesses. Likewise, single metastatic abscesses are amenable to this type of operation. For multiple metastatic abscesses, no surgical procedure can be expected to offer relief. If the abscess is located in the parietal lobe, necessitating a partial removal of the cortex, a monoplegia, or even an hemiplegia, is to be preferred to a fatal result. In those cases of cerebellar abscess, where the abscess is situated on the anterior surface of the cerebellum, and the lateral sinus is involved, the approach described by Eagleton, with ligation and division of the lateral sinus, probably will give best results.

In the small remaining group of patients where the abscess is basilar in position, and no opportunity is offered for removing the wall of the abscess in order to allow of herniation, the two stage procedure described by Dowman is the operation of choice, if the abscess can be located.

In recapitulation, the procedure described in this paper is applicable for all cases of brain abscess, in which the "roof" of the abscess can be removed and the abscess cavity can herniate through the cranial defect. Fortunately, these cases are the more frequent and comprise the vast majority of all brain abscesses.

POSTOPERATIVE TREATMENT

Instillation of surgical solution of chlorinated soda should be done every two hours. Daily dressings should be made by the operator himself so that he will be thoroughly acquainted with the situation throughout. The first dressing is done on the first day following operation. All of the dressing, including the rubber dam overlying the cranial defect is removed. It will be observed that the floor of the abscess cavity will have reached the level of the inner table of the skull. If not, this level will have been reached at the end of forty-eight hours.

The dressings have been simplified by the use of an apparatus (Fig. 1) devised and made by me for the double purpose of irrigation and protection of the area, including the after forming hernia cerebri. It consists of a ring made of an 0.7 inch rubber tubing, sufficiently large to cover the operative area or wound. Attached to the upper margin of the ring is a domelike rubber dam cap, which covers the hernia. For irrigating purposes, it is supplied with a Dakin's perforated tube which passes around, in a circular manner, the upper border of the ring inside the rubber dam cap. There are four loops placed 90 degrees apart, by

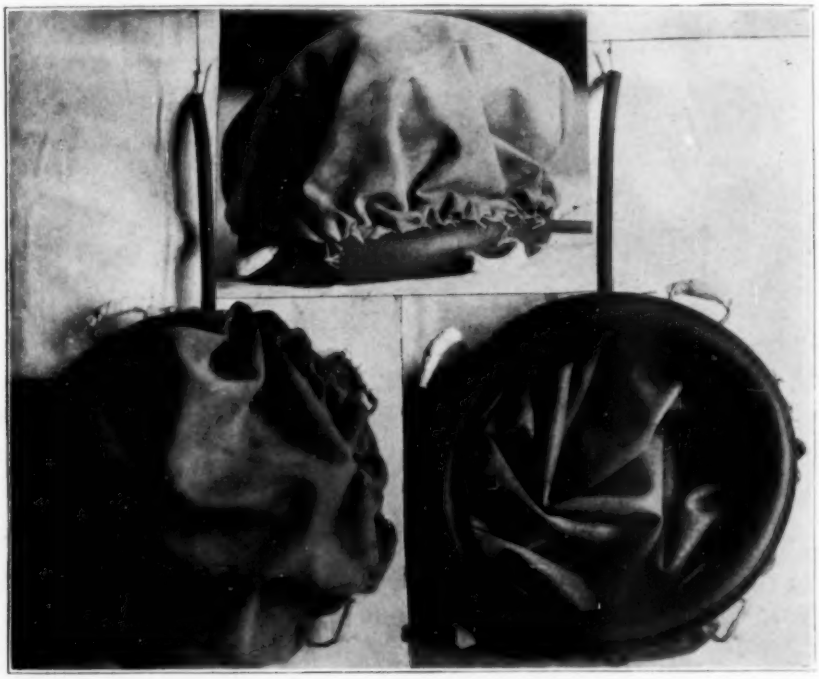

Fig. 1.—Three views of the cap-shaped apparatus used for the double purpose of irrigation of the wound and protection of the hernia cerebri. The perforated tube can be seen inside of the rubber dam cap.

means of which the apparatus is fastened to the head by adhesive strips.

At the first dressing and at the succeeding daily dressings, the scalp is covered with petrolatum gauze. Over the site of the operation, including the scalp flaps, cranial defect, etc., the apparatus is placed, and fastened to the head with adhesive strips to prevent displacement. This constitutes the essential part of the dressing. The remainder consists of gauze and combines held loosely around the apparatus, without

making compression, for the sole purpose of absorption of the used solution. The tube leading from the apparatus is connected with an irrigating bottle and the area is flushed every two hours (Fig. 2). On the fifth or sixth day, the three iodoform gauze strips are removed from the margin of the cranial defect. By this time the danger of extension of infection into the meninges will have passed, as the area will have become well walled off. The apexes of the scalp flaps are released and are allowed to fall forward against lateral surfaces of the hernia, to which they will become attached in a few days. By the eighth or ninth

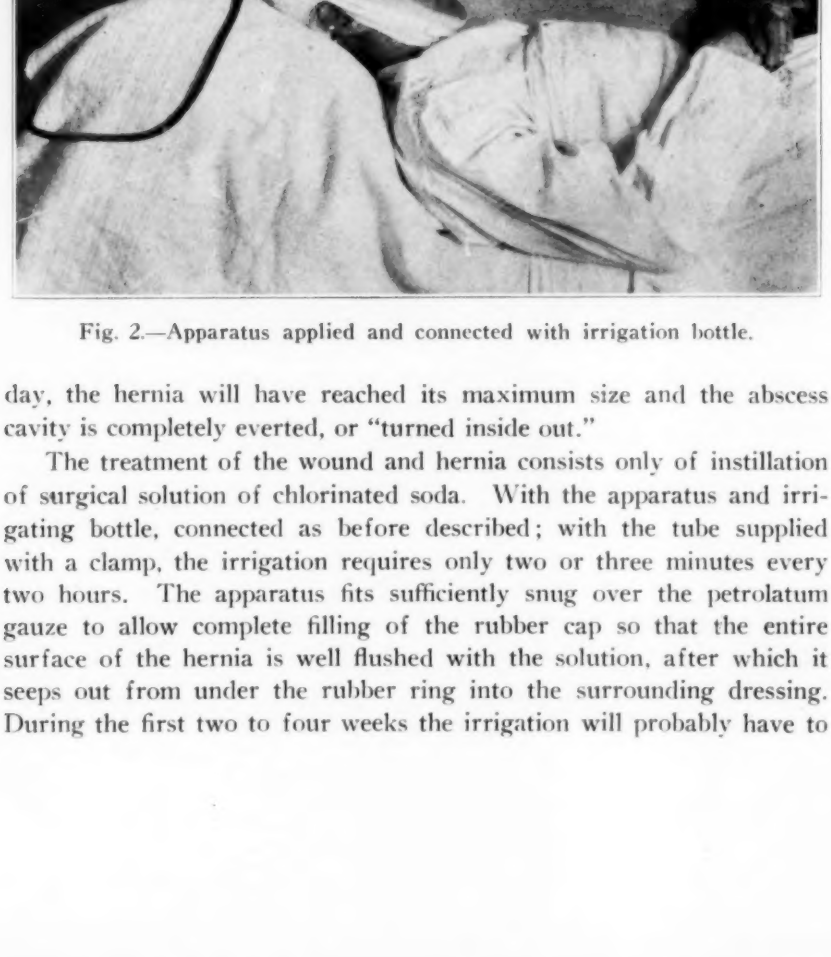

Fig. 2.—Apparatus applied and connected with irrigation bottle.

day, the hernia will have reached its maximum size and the abscess cavity is completely everted, or "turned inside out."

The treatment of the wound and hernia consists only of instillation of surgical solution of chlorinated soda. With the apparatus and irrigating bottle, connected as before described; with the tube supplied with a clamp, the irrigation requires only two or three minutes every two hours. The apparatus fits sufficiently snug over the petrolatum gauze to allow complete filling of the rubber cap so that the entire surface of the hernia is well flushed with the solution, after which it seeps out from under the rubber ring into the surrounding dressing. During the first two to four weeks the irrigation will probably have to

be done by an attendant or nurse; thereafter, the patient will be able to do this when awake (Fig. 3). The fourth patient operated on was able to attend to the irrigation a few days after the operation.

The hernia becomes of considerable size, from that of a lemon to that of a small orange, i. e., a mass from about 1.5 to 3.0 inches in diameter and protrudes above the level of the scalp from 1 to 2 inches. The rubber dam cap of the apparatus is sufficiently large to accommodate any hernia which may occur. The hernia should never be cut away. After the hernia has developed, it is necessary only to do the

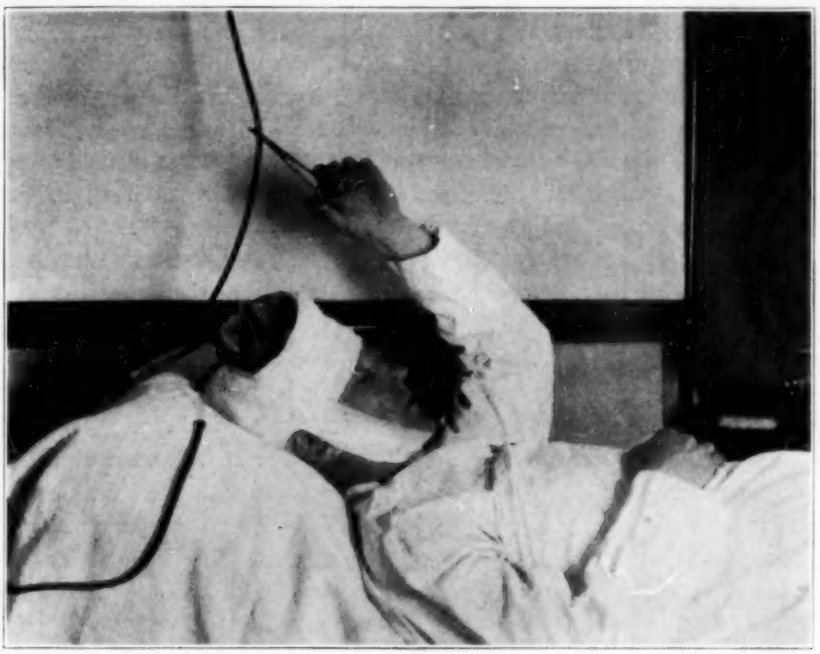

Fig. 3.—The patient releases the clamp and flushes the wound every two hours.

following: first, to protect the hernia from pressure and trauma; second, to prevent over herniation by lumbar puncture; third, to keep the area thoroughly irrigated with surgical solution of chlorinated soda; fourth, to keep the patient quiet in bed during the first three or four weeks while the hernia is at its maximum size, with avoidance of physical exertion.

To prevent over herniation, if such a condition should arise, lumbar puncture should be done once or perhaps two or three times, with the withdrawal of from 25 to 30 c.c. This should not be done until after about fourteen days so as not to loosen the protecting adhesions

surrounding the cranial defect. During the lumbar puncture it will be observed that the hernia becomes smaller, "flabby," and may even become somewhat concave instead of convex over the surface. Recession of the hernia following lumbar puncture is greater and more marked in the case of frontal lobe than in temporosphenoidal lobe abscess. This is due to the fact that the brain substance constituting the hernia is thinner in the former than in the latter.

In the patient observed, slight superficial sloughing occurred, these areas being confined to the cut margins of the brain and the capsule of the abscess cavity. No sloughing occurred around the lateral surfaces of the hernia, where the scalp flaps were attached. In no instance has deep or massive sloughing of the hernia occurred. The superficial sloughs which may occur should not be cut away, but should be allowed to detach themselves so as not to traumatize the hernia. After three or four weeks the surface of the hernia will become covered with healthy, red, granulation tissue. It will also become somewhat fibrosed, affording greater resistance so that it will not increase suddenly in size with coughing and sneezing as it does in the earlier stages before fibrosis or partial cicatrization has taken place. The hernia will also begin to diminish in size each day. It will be observed that the epithelium has begun to grow out over the surface of the hernia, extending from the margins of the flaps. At this stage the apparatus described should be discarded and a slight compression dressing be applied. The dressing used consists of perforated adhesive strips placed directly over the hernia and strapped around the head. Over the strips wet compresses are placed, and held with a bandage. Irrigation with the solution will no longer be needed. External wetting of the dressing every three or four hours will suffice. The epithelium grows rapidly under the adhesive strips as the hernia gradually subsides. Finally the area will be completely covered over for the most part with the scalp flaps, with an interval between the flaps consisting of nonhairbearing scar.

The average time which will be required from the time of operation until the hernia has completely receded, and the granulating surface has become covered with epithelium is about from two to three months. The level of the site at which the hernia occurred has now become flattened, the hernia has completely subsided, or the area may even be slightly depressed. The patient will then show the typical, physical signs of the usual cranial defect, i. e., pulsation corresponding to the heart beat, impulse on coughing or sneezing, a tendency to slight bulging or herniation when the patient leans toward the side on which the cranial defect is situated, and a slight depression when the patient leans in the opposite direction or sits in an upright position will be present.

Hernia Cerebri in General.—The treatment described in the foregoing applies to hernia cerebri in general. We have demonstrated this to our satisfaction in the last two and a half years in Bellevue Hospital. All patients which I have seen treated in this manner at this hospital have recoverd.

LATER OPERATIVE PROCEDURES

Scalp Plastic Operation.—After a period of one year or more following complete healing of the wound, a scalp plastic operation with excision of the nonhairbearing scar is advisable in certain cases. This has already been done in the second and third patients. The first patient did not desire it on account of the inconspicuous scar. In the fourth, the scalp plastic operation will be performed after six or seven months.

A Brief Summary of Cases *

Case; Age; Date of Admission	Location of Abscess	Following	Date of Operation for Abscess	Cultures	Capsule Present	Complete Recession of Hernia after	Leakage of Cerebrospinal Fluid from Vent.	Wound Healed after	Highest Postoperative Temp.	Returned to Work
1 28 7/5/20	Temporosphenoidal, left	Simple mastoidectomy	7/22/20	Streptococcus	Yes	57 days	None	60 days	101.2 on 2d day	About Dec. 15, 1920
2 46 3/17/23	Frontal right	Compound fracture of skull involving right frontal sinus	3/26/23	Staphylococcus	Yes	71 days	None	109 days	100.6 on 3d day	About Aug. 15, 1923
3 26 3/26/23	Temporosphenoidal, left	Simple mastoidectomy	3/27/23	Streptococcus	No	44 days	From 7th to 12th day	67 days	100.8 on 1st day	Sept. 7, 1923
4 22 2/7/24	Parietofrontal right	Compound fracture of skull with retained foreign body	2/28/24	Staphylococcus	Yes	22 days	None	40 days	100.2 on 1st day	May 6, 1924

* All patients recovered.

Cranioplasty.—After a period of about two years, the cranial defect can safely be repaired according to the method or procedure fully discussed in a former paper.[4]

SUMMARIES OF CASE REPORTS

Summaries of the first three patients, which were cases of true brain abscesses, are reported in my original paper. Two were temporosphenoidal lobe abscesses, and one was a frontal lobe abscess. They are but briefly summarized in the table. A summary of a report of a fourth case treated in this manner will be given.

4. King, J. E. J., and Anderson, S. C.: Cranioplasty: Indications, Operation and Results, South. M. J. **13**:719 (Oct.) 1920.

Case 4.— A. S., a man, aged 22, American, a bank clerk, was admitted to the Medical Division, Bellevue Hospital, Sept. 17, 1923. He was admitted to our service on Feb. 7, 1924.

The patient received a gunshot wound in right side of head, September, 1922, while serving with the Navy in Santo Domingo. There was a compound fracture of skull in the right parietofrontal region; as a result of which the man was unconscious for twelve hours. An operation was performed, the wound healed, but suppurated three weeks later and was incised. There was a discharging sinus until Jan. 2, 1923. The wound closed and remained closed. There was no further trouble until September 17. On this day the patient's mind was confused all day. In the afternoon there were generalized convulsions. He was

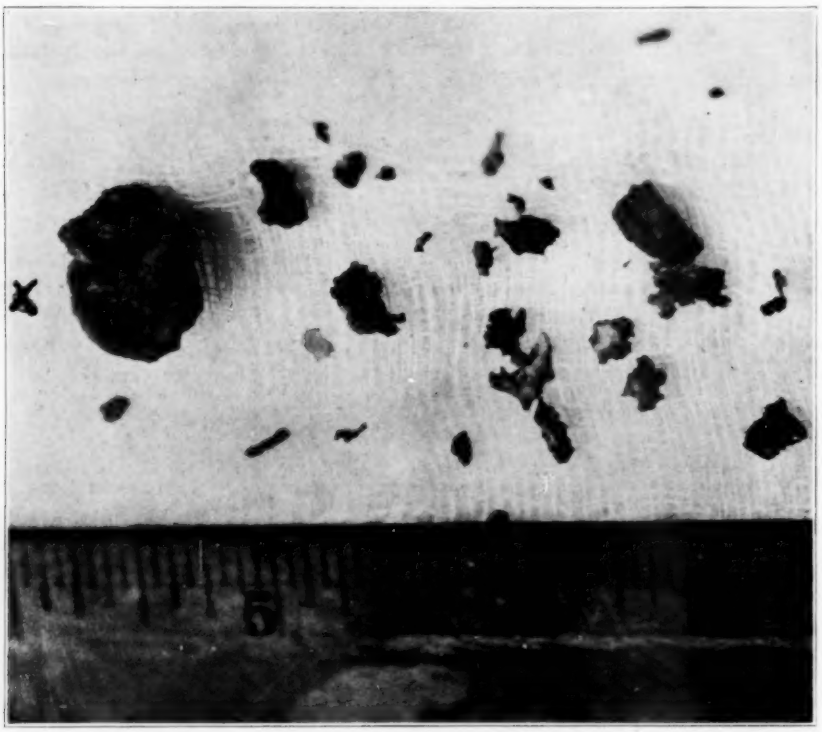

Fig. 4.—Sequestra removed from the abscess cavity which formed about the foreign bodies. Roof of abscess cavity shriveled up by formaldehyd indicated by X.

brought to Bellevue Hospital in an unconscious condition, and remained in a semiconscious or stuporous condition for several days, when on September 23, there was a fluctuating point in the scar and the patient was practically free from symptoms. Roentgenographic plates, which had been ordered, could not be found. September 26, an operation was performed; local excision of the infected, fluctuating portion of scar was made, and the wound was packed wide open. Culture showed *Staphylococcus aureus*. No tract or fistula was found at this time leading into the brain substance. No sequestra was found about the margin of cranial defect. Deep exploration was not done, owing to presence of pus.

No roentgen-ray examination was made, as there was a possibility that the abscess of scar or scalp was superficial, and the condition cleared up when it "pointed." It was thought that the symptoms might have been due to inflammatory process in the cortex and meninges adjacent to the wound. The probability of abscess was discussed, but considering that his symptoms had disappeared, it was considered best to do no further exploration. In a few days the patient was up and about the ward. On October 13, after the wound had been well irrigated and was clean, the wound and scar were excised by

Fig. 5.—Roentgenogram, showing the cranial defect through which the foreign bodies were removed (Case 4).

Dr. Martin and the scalp edges approximated. October 21, when the sutures were removed, there was no evidence of infection. On October 23, two days later, the middle portion of the scar appeared inflamed, separated, but there was no pus. Convulsions occurred on this day and the patient had several convulsions daily until October 31, when they ceased, coinciding again with appearance of the discharge of a small amount of pus from the wound. Without further operative procedures the discharge ceased. The patient was discharged from hospital, November 11, with instructions to report at once if any symptoms developed.

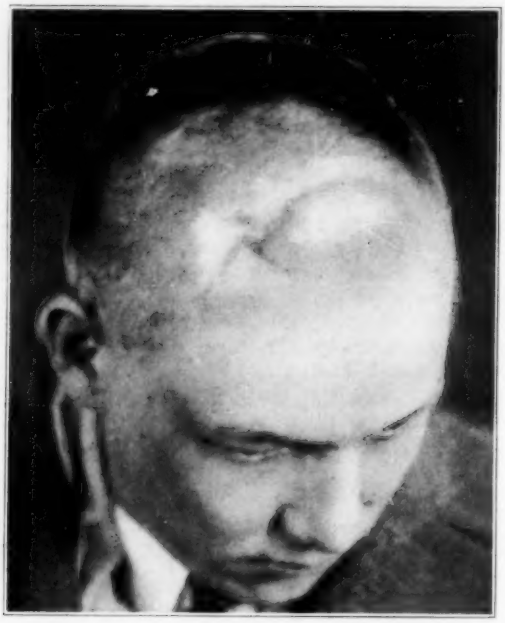

Fig. 6.—The scar of the same patient after healing, forty-two days after operation.

Fig. 7.—The same patient, three months after operation.

It was believed at the time that there was probably or possibly an old chronic brain abscess, associated with an old gunshot wound of head, due to the following: Two distinct attacks or series, of convulsions which disappeared as soon as the wound was opened and discharged. Roentgenographic plates showed sequestration, small pieces of bone either about the outer margin of the bone defect or in the brain substance. The patient was allowed to go home, but with the belief that he would probably soon return. Again he had convulsions, returned to our service and was operated on for brain abscess Feb. 28, 1924. A small sinus was found leading down to a well walled off abscess cavity, containing pus and sequestra. The roof of the abscess, which in this case was already perforated by sinus, was excised and the sequestra removed (Fig. 5). Firm adhesions about the area were found, but little tendency to herniate; the tissue was firm and fixed. The apparatus was applied, by means of which the patient was able to irrigate the wound. The herniation was less than in other cases. April 2, the thirty-third day after operation, the patient was up and about the ward; the wound was almost covered with epithelium. April 9, he was discharged, with the wound completely healed. He is now working as a collector until the scalp plastic operation.

At this point, I wish to suggest that all operators and authors should differentiate when reporting cases between true brain abscesses and so-called "brain abscesses" associated with retained foreign bodies, such as sequestra, missiles, etc., following compound fractures of the skull.

CONCLUSIONS

1. Various operative procedures heretofore described, in which numerous kinds of drainage materials were used, have usually been followed by a high mortality rate.

2. In all of these procedures described, prevention of hernia cerebri has been desired.

3. In this paper, the operative technic and postoperative treatment embrace the following: Creation of a rather large cranial defect directly over abscess cavity; complete "unroofing" of the cavity; complete herniation or eversion of the cavity; irrigation with the solution of area the apparatus devised for this purpose; prevention of trauma and early compression of hernia cerebri; lumbar puncture, if necessary, after the first two weeks; recession of hernia; adhesive plaster strapping; epithelization.

4. Results: Four patients consecutively operated on in this manner have recovered; three of them with true brain abscess and one with traumatic brain abscess surrounding a retained foreign body. There was no mortality rate.

114 East 54th Street.

THE PRESENT STATUS OF THE INTRANASAL ETHMOID OPERATION *

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Thirty-five years ago the operative procedure in the nose was very crude. Nasal obstruction was generally relieved by using a strong, broad forcep, which was inserted in the nostril, and everything that could be grasped, was, with a twisting, pulling motion, removed from the nose. Then the cure of all our nasal ills was tried by removing the lower turbinates. Owing to the dry condition of the membrane thus produced, it was found better to attack the septum, attempting to correct its shape by cutting and reforming, leaving the lower turbinates in place.

The removal of the anterior ends of the middle turbinates relieved many headaches and sinus infections, and regardless of the development of the submucous resection of the septum, the operation was gradually extended until the entire middle turbinates were removed to relieve these conditions.

This indiscriminate removal of the middle turbinates and the ethmoidal cells caused disagreeable conditions, especially in dry, cold climates, bringing many complaints, regardless of the fact that the operator assured the patients they would become accustomed to the conditions.

These after-effects turned many rhinologists to conserving these tissues. It was found that exenteration of the ethmoids and opening the frontal sinuses intranasally could be performed just as well by leaving the middle turbinates in place.

ANATOMY

The nasal cavity is divided by the septum into two fossae. Each fossa has the independent lower turbinal body attached to the lateral wall below. Above this body, on the lateral wall, is a space filled with the ethmoidal capsule, which consists of a cavity partitioned into cells, known as the anterior and posterior ethmoidal cells. These cells are bounded on the lateral wall by the orbital plate, which constitutes one wall of the ethmoidal cells that line it. They are bounded above by the horizontal frontal plate, which is the superior wall of such cells

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that lie against the plate. They are bounded mesially by the so-called middle and superior turbinates, a thick perpendicular plate which forms the mesial wall of such cells that border it. It is seen then that the limits of the ethmoidal capsule are bounded by firm walls of bone, and if these cells are exenterated, it leaves a definitely formed space.

In the roof of the nasal fossa, between the attachment of the mesial wall of the ethmoidal capsule and the septum, lies the cribriform plate, through which pass the olfactory nerves to spread over the upper one-third of the mesial wall of the ethmoidal capsule and a like space on the septum. These nerves, with their sheaths, form a direct communication with the olfactory bulb and the meninges. While the foregoing is the normal placing of the distribution of the olfactory nerves, they can cover

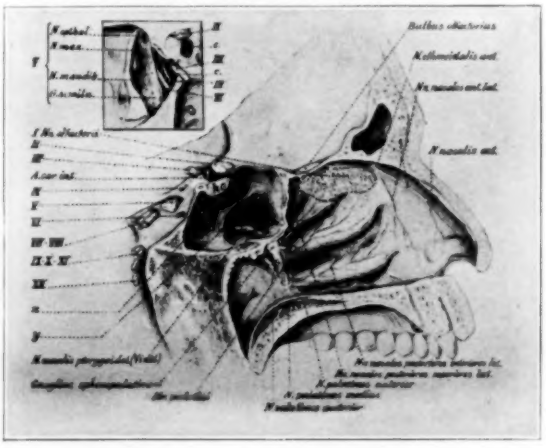

Fig. 1.—Normal distribution of the olfactory nerves on the lateral wall of the nose.

the entire mesial wall of the ethmoidal capsule, including the overhang, as demonstrated by the illustrations which are shown here.

With reference to the sheaths of the olfactory nerves, I quote Dr. J. Parsons Schaeffer:

> There is no doubt that the perineural spaces about the olfactory filaments are opened when the olfactory field is encroached on in intranasal operations. This, of course, would lead to a direct communication between these spaces and the nasal fossa; moreover, might serve as a direct path to carry infection from the nasal fossa to the meninges. It would appear established that the subdural space directly communicates with the perineural spaces of the olfactory nerve fila. The exact anatomic relationship between the perineural spaces and the intranasal lymphatics needs further study.
>
> Any operation on the ethmoidal labyrinth that would save in toto the olfactory mucosa, whether by staying below the olfactory area or working behind the overhanging middle and superior conchae would, from an anatomic point of view, be better, since the spaces about the olfactory nerves would then remain intact.

That the cribriform plate is occasionally injured in intranasal operations on the ethmoidal labyrinth must be so. This would, of course, lead to meningeal contamination directly. The normal nearness of the ethmoidal cells to the dura mater also is important in neglected cases. Any operation that would safeguard the olfactory mucosa and the spaces about the olfactory nerves, would also go a good way in preventing injury to the cribriform plate. That

Fig. 2.—A drawing of the lateral wall, showing the olfactory nerves distributed over the entire middle and superior turbinates.

Fig. 3.—A drawing of the lateral wall of a child, aged 1 year, showing olfactory nerve bundles with blood vessels and connective tissue (Read).

the old operation which exenterated not only the ethmoidal labyrinth, but the entire olfactory area on the lateral nasal wall, certainly widely opened the olfactory nerve spaces. However, I understand that the better operators now make an effort to save the olfactory area. Indeed, I gathered from the Conference at Washington, that destruction of the olfactory area was not only a bad thing to do, but was wholly unnecessary.

In the report of meningeal fatalities by Dr. Loeb, at Washington, in 1922, there were eighty-six deaths dealing with operations in the ethmoidal region, in each of which part of the olfactory surface was undoubtedly injured. While he attempted to prove that the meningitis was attributed to fracture or injury to the cribriform plate, it was only traceable in a few cases, while the great majority showed no direct violence.

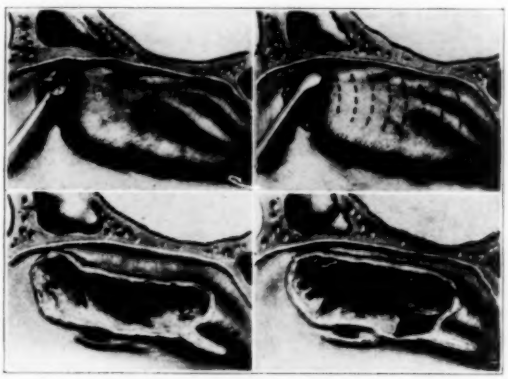

Fig. 4.—The completed ethmoid operation as recommended by Dr. Mosher (Loeb).

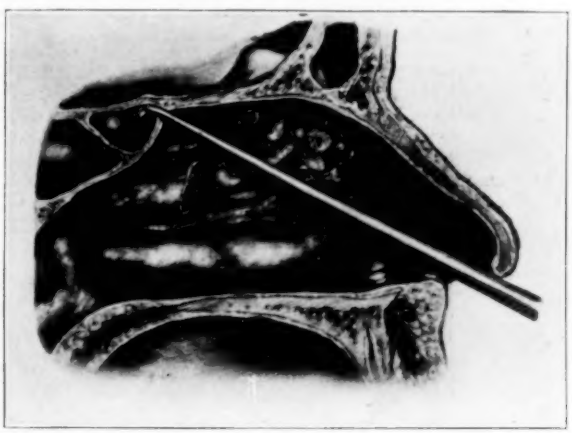

Fig. 5.—The completed ethmoid operation as recommended by Dr. Sluder (Loeb).

In order to determine whether deaths from meningitis following surgery in the ethmoidal region were due to the method or possibly to the kind of operation performed, I sent a questionnaire to 165 of the leading rhinologists of North America, each of whom is a Fellow of the American College of Surgeons.

In answer to my first question: "Do you know of any authentic deaths from meningitis following operations on the ethmoid region?"

fifty-two of the 108 answers received reported eighty deaths from meningitis in their immediate practice. Fifteen of the 108 reported hearsay evidence of thirty-three deaths from meningitis following nasal operations, the remaining forty-one reported no deaths, but many stated they did very little surgery on the ethmoidal region.

When you think of eighty deaths from meningitis reported by fifty-two of our leading rhinologists, can you imagine the number caused by

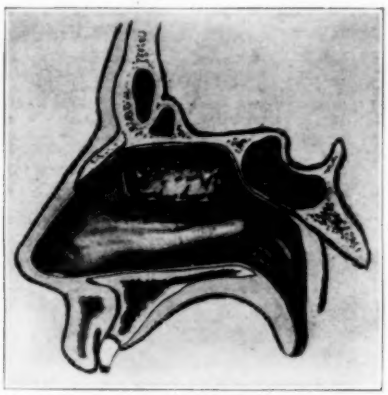

Fig. 6.—The completed ethmoid operation as recommended by Dr. Coffin (Phillips).

Fig. 7.—The completed ethmoid operation as recommended by Dr. Hajek (Skillern).

those less skilled? Should not this appalling condition receive our most serious consideration?

In answer to my second question: "In these patients was the entire middle turbinate removed?" in forty-eight of the eighty deaths all of the middle turbinate was removed. Two reported the middle turbinate was not disturbed.

In answer to my third question: "In these patients was part of the middle turbinate removed?" twenty-one answered that part of the middle turbinate was removed and in the remaining nine patients polypi had been removed by evulsion, giving more or less injury to the middle turbinate. Thus seventy-eight of the eighty deaths showed injury to the olfactory region.

In answer to my fourth question: "In exenterating the ethmoids intranasally, do you remove the middle turbinate in whole or in part?"

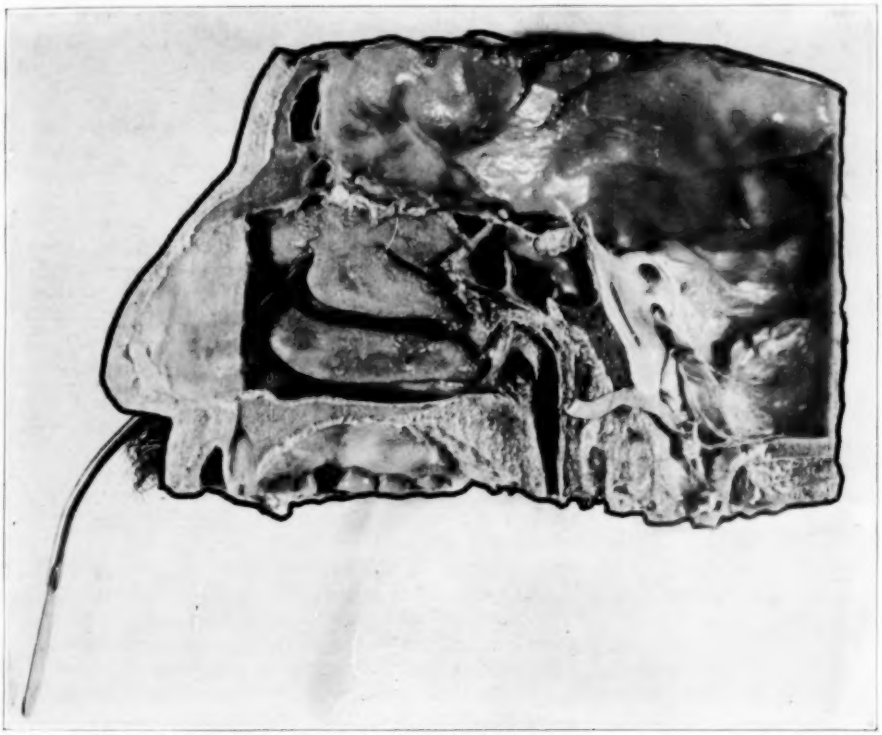

Fig. 8.—The completed ethmoid operation with the middle turbinate in place, as recommended by Dr. Pratt.

all but fifteen of the 108 answered that they did. Of the fifteen who did not remove the middle turbinate, all but three were from the Middle States.

In both Dr. Loeb's report and my own there seems to be a very direct path for infection from the nose to the meninges, which cannot be accounted for by injury to the cribriform plate alone. It seems that operations in the nose that do not molest the cribriform plate or olfactory surface are seldom if ever followed by meningitis. It tends to prove quite conclusively that neither the middle turbinate nor the mesial wall

of the ethmoid should be removed, except under the most urgent necessity, for with the pathway open and the infection present, meningitis may develop.

COMMENT

Therefore, this tends to prove quite conclusively that the extension of the infection is probably along the olfactory nerves, undoubtedly through the nerve sheaths.

That the olfactory nerves may cover all or any part of the middle turbinate, and the removal of any part of the middle turbinate, during an ethmoid operation, may open this avenue for infection.

ABSTRACT OF DISCUSSION

DR. ROSS H. SKILLERN, Philadelphia: I gathered from what Dr. Pratt said that there are two schools in operating on the middle turbinate, those who remove a portion, and those who remove none. I did not know that. I thought there were those who remove a portion, and Dr. Pratt. However, I stand corrected. It seems to me that in any ethmoidal surgery it is absolutely necessary to remove a portion of the middle turbinate. Why? I believe it is not the drainage alone, by any means, but the aeration that helps to bring about the cure. I believe aeration in ethmoid work is more important than drainage, and how we can get sufficient aeration without removing at least a portion of the middle turbinate, I do not know. In wide noses, of course, it is perfectly possible to leave the middle turbinate in place and, perhaps, clear out the ethmoid; but in narrow noses we cannot do it at least as far as I am concerned. I cannot get underneath the middle turbinate and remove to my satisfaction the ethmoid cells and know when I get through that I have made a complete operation. The point, however, that Dr. Pratt brings out that appeals to me most strongly — and I am sure if Dr. Pratt knew that we would take this one point home with us and apply it he would be pleased, that is regarding the injury to the terminal filaments of the olfactory nerve. He showed one picture where the nerve filaments apparently covered the entire middle and posterior turbinates. I think there must be some mistake in the interpretation of this specimen. They say 254 micromillimeters is about the extent of area of the filaments of olfaction on the lateral wall of the ethmoid, and that gives us over 1 cm. above where the middle turbinate becomes a part of the ethmoid. Therefore, we can operate with perfect safety and remove the middle turbinate up to that point, and not only do I think it is safe, but I think it is necessary in order to do this work as it should be done to obtain the maximum of operative benefit.

DR. CHARLES W. RICHARDSON, Washington, D. C.: This subject of proper surgical intervention in the ethmoidal region is of the greatest importance. I do not think that there is any work we do that is so imperfectly done as ethmoid surgery. We must consider it from an anatomic, physiologic, pathologic and surgical point of view. I quite agree with the author with regard to the possibility of infection extending along the course of the filaments of the olfactory nerve. I do not agree with him with regard to ethmoidal surgery and its connection with the removal of the middle turbinate. I rather agree with Dr. Skillern. I do not believe that theorizing is of any value in this connection. I believe that necropsy is the only manner of differentiation of the cause of these deaths from meningitis after the internasal operation. I have never had a death in intranasal operation in connection with this surgery. I always remove the middle turbinate, or the greater portion of it. I believe that we should do this work along proper surgical lines, and I do

not believe that in internal work on the ethmoidal cells we are doing surgery of the proper nature. I have given up internal work because I know that I can do better surgery, as surgeons do their work, by external attack. Anteriorly placed, or misplaced cells cannot be reached by internal surgery. The operation as done by external methods with proper care and technic leaves practically no scar.

Dr. Cullen F. Welty, San Francisco: I consider ethmoid suppuration one of the most difficult of all the nasal conditions to bring to an absolute cure. I have tried several different procedures. For quite a while I was enthusiastic about leaving the middle turbinate for obvious reasons and I had some good results. But it was not always satisfactory in my hands and for a number of years I have removed the whole of the middle turbinate. I operate something like this: I do not attempt to cure in one, two, or in three operations. I do not know how long it will take, but I tell them that if they remain with me long enough I will cure them. Sometimes large cells extend over the orbit and it is out of the question to bring these through without an outside operation. If I remove every vestige until I see everything clear in the upper part of the nose and there is still pus coming, it is quite apparent that an external operation is necessary to bring it to a successful issue.

I wish to report one death which was very unusual. This man had the operation in the hospital and the next day I removed packing from the nose. When I took out the packing it began to drip cerebrospinal fluid. This continued for about a week, with a temperature from 100 to 101 F. This gradually subsided and he left the hospital at the end of a week. He came to my office and I kept the wound clean. In about six weeks he went on a spree and vomited so hard that he vomited through the nose, with the result that meningitis developed that killed him. I had a postmortem examination made and found a perforation of the dura, a sort of flap. Evidently it had dipped into a cell and was injured. This valve-like flap had protected him for six weeks, but it broke away during the vomiting attack and he was infected with meningitis.

Dr. Edwin McGinnis, Chicago: I do not like to disagree with Dr. Skillern and Dr. Richardson, that you have to take off the middle turbinate. Why do you do it? The reason we used to take off the middle turbinate was so that we could get a view of the ethmoidal labyrinth. If you take out the upper part of the septum you can do anything you want with the ethmoidal labyrinth. You can exenterate the cells or take the bottom out of them; you can leave the mucous membrane or remove it. Sometimes during this operation I am surprised to find only two or three cells affected and the rest practically normal. When you get through with these patients in whom you have preserved the middle turbinate and done a decompression operation you have a perfectly normal inside contour of the nose. If they happen to go to someone else, the landmarks are there. If they happen to catch cold and the cells are closed, they can be reopened, and if you have to take off the middle turbinate it can be done any time. But if you leave it the patients are better satisfied than when you do a complete exenteration of the ethmoid, and the end-result is more satisfactory from our point of view.

Dr. J. A. Pratt: With reference to whether the ethmoid operation can be performed under the middle turbinate, I see before me many men who have been at my clinic and can vouch for the operation. As Dr. McGinnis says, if the working space is too narrow, a submucous resection can always be performed. As the ethmoid cells are broken down, the middle turbinate can be pressed aside, as it is freed from its lateral wall attachment. Nearly all discussions on ethmoid work bring forward the abnormalities found in the ethmoid cells, but they are few and far between. You may find them possibly in 5 per cent. of the cases, and it is seldom that they cannot be reached under the middle turbinate. When you do an exenteration under the middle turbinate you have perfect drainage with no loss of physiology, and if it is done properly, you make this group of cells into one large cell, into which

opens the frontal sinus. Any abnormally situated cell can be traced by the discharge and the enlarged ostia. Of course, there are cases that necessitate external operations, but they are rare. With reference to these deaths, there can be no dispute about any case reported, but it is significant that in each of the seventy-eight fatal cases some or all of the middle turbinate had been removed. One might go along indefinitely and never have a death. We have never had a death from meningitis and we perform these operations in the dispensary and the office, allowing the patient to go home. We have possibly been fortunate in never having had a secondary infection or hemorrhage.

RESULTS OF TREATMENT OF CARCINOMA OF THE ESOPHAGUS BY THE COMBINED USE OF RADIUM EMANATIONS AND THE DEEP ROENTGEN RAY

REPORT OF SIXTEEN PATIENTS TREATED AT THE MASSACHUSETTS GENERAL HOSPITAL AND THE HUNTINGTON MEMORIAL HOSPITAL

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BOSTON

In a communication to the association three years ago I reported the results in eighteen cases of cancer of the esophagus, treated by the implantation of radium emanation "seeds" under esophagoscopy. A temporary improvement, as evidenced by a greater ease in swallowing and a slight increase in weight, which lasted from a few weeks to a few months, was noted in most of the patients after this method of treatment. The improvement was only temporary in all cases, and I was unable to report any patient who had survived for more than eight months after the beginning of treatment. Patients treated by the same method since that time have shown practically the same results. With the introduction of the high voltage roentgen-ray treatment, it was hoped that a reinforcement of the effect of the radium emanations might be obtained which would produce more lasting benefit. In the present series of sixteen cases, extending over the last two years, all patients were treated both by radium emanations and the deep roentgen ray. In a few cases the roentgen-ray treatment preceded the radium, but in the majority it was employed subsequent to or in conjunction with the radium treatment.

THE METHOD OF PROCEDURE

In the first place the preliminary diagnosis is made from the history of the patient, and by means of fluoroscopy and roentgen-ray pictures, which indicate the location and to some degree the extent of the growth. Esophagoscopy is then performed, usually under ether anesthesia. The appearance and characteristics of the lesion are noted, a small specimen removed for microscopic examination and the permeability of the stricture to bouginage observed, without any attempt at forcible dilatation. The insertion of radium emanation seeds into the growth is done with the same type of trocar which I had exhibited previously. The only modification consists in a small, olive shaped guard which is placed 1 cm. from the tip, to assist in gauging the depth of insertion and obviate

too deep penetration. This useful feature of the instrument was devised by my colleague, Dr. G. A. Leland of the Huntington Memorial Hospital, for trocars used in uterine cases.

In delivering a given dosage of emanations, it has been found more effective to distribute the total amount in a number of small seeds than in a few larger ones. The smaller seeds also produce less sloughing and are therefore less likely to result in perforating ulcers. In most

Summary of Cases

Number	Sex*	Age	Location	Radium Treatment	Deep Roentgen Ray Treatment	Duration of Life	Result
1. E. B. C.	♀	69	Upper third	2	2 series	1½ yr.	Marked retardation and reduction of growth. Swallowed liquids up to end. Death from other causes
2. B. T.	♂	65	Lower third	2	2 series	4 mo.	Slight local improvement. Swallowed liquids up to end. Death from inanition
3. J. G. F.	♂	60	Upper third	3	2 series	6 mo.	Improvement for five months, cause of death not known
4. A. R. C.	♂	43	Lower third	1	1 series	6 mo.	Marked improvement for four months. Cause of death not known
5. V. I.	♀	42	Upper third	3	1 series	4½ mo.	Marked improvement for two months. Swallowed liquids up to end. Death from cerebral embolus
6. M. A.	♀	54	Upper third	1	1 series	2 mo.?	Did not report. Untraced
7. W. H. G. ...	♂	59	Lower third	1	1 series	2 mo.?	Did not report. Untraced
8. S. P.	♀	58	Middle third	2	1 series	5½ mo.	Improvement for one month. Swallowed liquids to end. Death from hemorrhage
9. H. L.	♂	54	Middle third	1	1 series	1 mo.?	Improvement in swallowing one month. Death from hemorrhage
10. J. S.	♂	52	Lower third	1	1 series	2 mo.?	No improvement one month. Did not report. Untraced
11. J. G.	♂	48	Lower third	1	1 series	3 mo.?	Local improvement but general weakening at last report. Untraced
12. A. L.	♀	55	Upper third	1	1 series	2 mo.	Under treatment
13. W. H.	♂	59	Lower third	1	2 series	4 mo	Slight local and general improvement. Under treatment
14. H. H. C. ...	♂	62	Middle third	1	3 series	6½ mo.	Under treatment. Swallowing well but losing strength
15. G. B. D.	♂	63	Upper third	1	2 series	3 mo.	Under treatment. Gaining three months after gastrostomy
16. A. M.	♀	42	Middle third	1	1 series	3 mo.	Under treatment. Improvement in swallowing and general condition at last report

* In this column, ♀ indicates female; ♂, male.

cases from four to six seeds, of 1 cm., were inserted at each treatment. The immediate reaction to this instrumentation and treatment is slight and the patients are usually able to leave the hospital on the following day. Within a few days a decided improvement in swallowing is usually observed, which is doubtless to be attributed to the bouginage. The deep roentgen-ray treatments have in most of the cases been given in a series of three or four exposures, extending over a period of from three to five days, beginning a few days after the radium treatment. In about eight weeks the roentgen-ray treatment is repeated. At irregular inter-

vals of about two months, the examination of the esophagus and radium treatment has also been repeated, but our impression has been that the most effective treatment has been the first one, and of late we have relied on the deep roentgen ray for therapy after the initial treatment.

RESULTS

The first patient who was treated under this general scheme, was a woman, aged 42, who showed a most remarkable temporary improvement after the first radium and roentgen-ray exposures. In two months she had regained her lost weight, and from being able to take only liquids with difficulty, was eating all kinds of solid food with very little trouble. There was also a return of normal vigor which was quite striking. After two months, however, the local and general symptoms gradually recurred and she died in four and one-half months. She was able to swallow liquids up to the end. The average duration of life of the sixteen patients, including five who are still living and under treatment, was four and one-half months. The longest was one and one-half years and the shortest one month. In two of the cases, death was reported as due to hemorrhage; in both of these the growth was located in the middle third of the esophagus. The duration of life was longest in the case of a woman who lived a year and a half after the beginning of treatment and died from other causes, but with the disease still present in the esophagus. Other statistics have been included in a summary which is appended.

Our experience has been paralleled by that of other workers in this field who have employed various methods of surface application of radium or the emanations in larger series of cases than ours, notably Quick of the Memorial Hospital in New York and Mills and Kimbrough of St. Louis. So far as I have been able to discover, there has been no authenticated case of cure of cancer of the esophagus by irradiation in this country.

Thus far the cases we have treated by the combined method have shown a slight improvement in results when compared with those treated by radium alone. Although the end-results so far have been disappointing, there are certain observations and deductions therefrom which I think give reason for some hope for better results in the future. In the first place, in contrast with the 100 per cent. mortality after irradiation in esophageal cases, we have seen many patients apparently cured by irradiation where the disease has been located in the pharynx. I have in mind especially one case of squamous cell carcinoma of the right side of the hypopharynx, of the size of a small walnut, growing from a broad base just above the introitus of the esophagus. This patient treated three years ago by radium emanation seed insertions has remained apparently cured to date. In the second place, these patients do not as a rule

die as a direct result of the local lesion nor from metastasis to other organs. This was illustrated in one of the only two patients in which I have been able to obtain a necropsy. This patient had been under treatment for eight months, during which time he had four radium insertions, was able to take liquids up to the last but gradually weakened and died. The necropsy showed that the greater part of the tumor had been destroyed. At the site of the lesion was an ulceration around the periphery, where cancer cells were found but no tumor. A few small neighboring glands also showed carcinoma cells. In other patients we have seen undoubted regression of the growth without improvement in local or general symptoms.

Another observation has been that the ability to swallow food does not correspond with the degree of permeability to the bougie. Certain patients with very tight strictures can swallow better than others with more permeable strictures, and sometimes a patient in whom the passage can be demonstrated to have become larger as the result of destruction of tumor tissue will have increasing difficulty in swallowing. It is evident that the muscular mechanism of deglutition in these patients is interfered with by the presence of the growth in the walls of the esophagus. In other patients where the destroyed tumor tissue has become replaced by fibrous scar tissue, a contraction of the lumen is to be expected. But whether there is actually complete obstruction or not, the patients gradually lose weight and strength and finally die. This brings up the question of keeping up the nourishment by gastrostomy and direct introduction of food into the stomach. It has seemed to me until recently that so long as a patient was able to swallow liquids or semisolid food without great difficulty, there was nothing to be gained in having a gastrostomy done, and it was my custom to wait until it was impossible for the patient to swallow liquids before advising a direct surgical opening into the stomach. It was not until a few months ago when I heard Chevalier Jackson demonstrate the advantage of early gastrostomy in cases of lye stricture, that the possible great advantage which might accrue from this operation in cases of carcinomatous stricture appealed to me. As Jackson has already pointed out, a patient with a partial stricture of the esophagus suffers not merely from difficulty in swallowing. Even in the case of partial strictures we often find on esophagoscopy a considerable retention of foul, stagnating material, fluid and semisolid detritus, the presence of which tends to keep up a chronic esophagitis. The absorption of the products of decomposition in itself is undoubtedly harmful, to say nothing of the distaste for food engendered by the disagreeable taste of the foul emitations of gas. This phase of the situation was particularly impressed on me in two cases which I was able to follow up rather more closely than usual. In both of these patients the swallowing of liquids was maintained with but

slight difficulty up to the end, and yet they both wasted away and died apparently of inanition. Both declared an absolute distaste for any food, had to force themselves to take it and finally refused to make the effort. In one of these patients esophagoscopy and bouginage done only a few weeks before death showed the esophagus more permeable than it had been two months before.

Although the operation of gastrostomy is relatively serious and productive of little benefit when practiced as a last resort in patients in the late stage of the disease, it is comparatively safe and results in marked improvement in general condition and in maintenance of body weight and strength when performed in the early stages. It is now my practice to recommend this operation as soon as the diagnosis is made and to forbid the taking of any food by mouth. With rest and cleanliness of the esophagus thus induced and nutrition maintained, it seems reasonable to expect more favorable results from irradiation than we have yet been able to obtain.

In conclusion, I present a brief report of a case which illustrates the beneficial effect of a fairly early gastrostomy.

REPORT OF CASE

G. D. B., a man, aged 63, consulted me Feb. 27, 1924, complaining of gradually increasing difficulty in swallowing for about three months, combined with considerable pain. A roentgenogram showed obstruction of the esophagus a little above the level of the sternal notch. On March 4, esophagoscopy was done under ether anesthesia. An obstructing growth was encountered below the cricoid, 8 inches (20 cm.) from the teeth, a hard irregular ulcerating tumor projecting into the lumen from the anterior surface. A specimen was removed for biopsy, and a bougie, No. 26 French, was passed with little difficulty through the stricture. Five seeds, each of 1 cm., were inserted into the presenting growth at different parts. The specimen of tissue was reported by the pathologist to be epidermoid carcinoma. Following the esophagoscopy and treatment, the patient suffered considerable pain and was scarcely able to swallow at all for three days, during which time fluids were given by rectum. Gastrostomy was then performed by Dr. Richard Miller, on March 7. Since then the patient has subsisted entirely on nourishment taken through the gastrostomy tube. The problem of feeding was complicated by the fact that he was a mild diabetic patient. An adequate diet however has been arranged for him by Dr. Elliot Joslin, which is compatible with his sugar tolerance, and under which he has gained weight. He is now able to swallow his saliva without discomfort or pain. A schedule of the diet is given.

At 7:00 a. m., 8 ounces water; 7:15 a. m., 4 ounces orange juice; 8:00 a. m., one-half of an eggnog; 10:00 a. m., 7 ounces milk, 6 ounces ginger ale; 12:00 noon, one-third portion gruel; 2:00 p. m., 4 ounces orange juice, 4 ounces Vichy water; 4:00 p. m., one-half portion eggnog; 6:00 p. m., one-third portion gruel, 4 ounces Vichy water; 8:00 p. m., 7 ounces milk, 6 ounces ginger ale; 10:00 p. m., one-third portion gruel. Three pints of milk were given daily. Every measure strong.

Formula for Eggnog.—Divide in two portions, 3 eggs, 12 ounces milk, 1 ounce sugar of milk, 1¼ ounce cream, 1 teaspoonful cod liver oil.

Formula for Gruel.—Divide in three portions, 1 ounce oat meal (strained), 1¼ ounce cream, 1¼ ounce olive oil, 1 ounce sugar of milk, 20 ounces milk, 1 ounce oats cooked with 4 ounces water, four hours.

ABSTRACT OF DISCUSSION

Dr. Harris P. Mosher: I am heartily in accord with Dr. Jackson regarding the removing of specimens. The smaller the specimen removed the greater the danger. Dr. Jackson, could you tell me about a patient who went to you after leaving me? The diagnosis was that the patient had an adenocarcinoma of the esophagus. I should like to know how many cases of undoubted ulcer of the esophagus have been operated on.

Dr. Swain: I have seen such a case of ulcer of the esophagus just below the introitus which was cured by the application of silver. The ulcer was not caused by any previous manipulation but might have been due to a burn. The only history was difficulty in swallowing.

Dr. Imperatori: I have seen a method for treating cancer of the esophagus by which fourteen patients were treated, ten of whom had gastrotomies. Radium was applied by means of a radium carrier somewhat in the fashion of the intubation tube, the carrier being introduced through a Jackson esophagoscope. The treatment apparently stayed the progress of the disease but no cures were reported.

Dr. Carmody: The previous year I reported two patients cured with radium. They remained quiescent only a few months. One died of pneumonia; the other is alive and working on a farm. In neither case was the diagnosis confirmed by microscopic sections. I think that the instrument used by Dr. Imperatori is similar to Dr. Plummer's. I have seen a patient with two ulcers, one was a small ulcer which cleared up with the application of iodin; the other was carcinomatous.

Dr. Burt R. Shurly: All patients which we have had under observation for the last twenty-five years succumbed until a year and nine months ago when we combined the treatment of radium with deep roentgen-ray therapy. We used a Wappler machine. The question of doses is of great importance. Comparatively few men at the present time really have knowledge enough of the subject to be able to estimate the proper dosage. There are a number of machines and undoubtedly they vary in their results. I believe that the filtration through copper makes the Wappler machine really efficient, and the results we have obtained are in advance of anything we have seen previously. One carcinoma of the tonsil and one at the entrance of the larynx entirely disappeared with the use of radium, deep roentgen-ray therapy. Three patients with carcinoma of the esophagus have been greatly improved.

Dr. Crosby Greene: It has been the experience in the Memorial Hospital in New York and at the Huntington Hospital in Boston that in cases of intra-oral cancer which are readily accessible, the most effective method of irradiation is by local implantation of radium seeds supplemented by deep roentgen ray from without. One patient in which the growth was in the hypopharynx just above the entrance of the esophagus was cured three years ago by this treatment. The success in such cases lends encouragement to apply this treatment in esophageal cases, although the implantation is considerably handicapped in locating accurately the emanation seeds to the growth. As to the danger of perforation from the action of the radium this can be minimized by the use of small seeds not over 1 mc. in strength and not too deeply inserted. In my last series there were no accidents from this source.

Dr. Jackson: Regarding the question raised by Mosher as to ulcer of the esophagus, the patient to whom he referred had the comparatively rare peptic

ulcers in the lower esophagus. These did not cause stenosis. Pain is often absent in cancer of the esophagus but the nonmalignant growths in the lower end, deluged by gastric juice, are often associated with intense pain relieved by sodium bicarbonate. This is not true of cancer. I am favorably impressed with Dr. Imperatori's instrument. I should suggest careful inspection of the string to which it is attached, as I knew about a radium capsule that had gotten away from the radiologist because of a broken string. At present we are all in accord with the irradiation treatment for cancer of the esophagus, and we have abundant clinical evidence that these growths are retarded and metastasis postponed in this way.

FURTHER STATISTICS ON CHLORIN GAS AS A TREATMENT FOR RESPIRATORY DISEASES*

MARVIN F. JONES, M.D.
AND
CHARLES GAROFALO, M.D.
NEW YORK

This investigation was begun July 1, 1924. Since that time we have treated about 300 patients and tabulated results on 220 of these are available for the present report. The total number of treatments given these patients was about eight hundred.

The method of liberating chlorin is practically the same regardless of the apparatus. One type of apparatus liberates free chlorin into the treatment room and depends on the dilution after liberation. The other type generates chlorin and makes the proper dilution before it is liberated. The principle of liberation is the displacement of water and measurement in cubic centimeters of the amount displaced. Each liberation is called one pulsation and varies in amount according to the type of apparatus. The dilution of chlorin in the room should remain constant and this is a technical difficulty in the treatment.

Clothing, metals, ventilation and humidity have to be taken into account, because chlorin is very rapidly absorbable. The proper amount of chlorin may be liberated into a room of known dimensions, but the before mentioned factors are so variable that some means of frequent determination of the chlorin content is indispensable.

The technic of treatment was the same as that reported by Vedder and Sawyer.[1]

During our first experiments, quantitative tests of the air were made at intervals of from five to ten minutes. We then made use of an instrument which continously recorded the amount of chlorin in the atmosphere. This instrument was run parallel to our quantitative tests and was found to be fairly accurate.

After working for a certain period of time, one is able to estimate the proper concentration of chlorin by the effect on one's own respiratory mucous membranes. The dilution used was that recommended by Vedder and Sawyer in their original report of the chlorin treatment.

During the last month of experimentation, a concentration of 0.02 mg. per liter was used. This dilution was found to be about as strong as the

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* From the Department of Laryngology, New York Post-Graduate Medical School and Hospital, service of Dr. Charles J. Imperatori.

1. Vedder, Edward B., and Sawyer, Harold P.: Chlorin as a Therapeutic Agent in Certain Respiratory Diseases, J. A. M. A. **82**:764 (March 8) 1924.

average patient could stand without discomfort. It was found that in the hot, humid weather of summer the concentration of 0.015 mg. per liter was as great as patients could stand without distress but in cool, dry weather 0.02 mg. per liter was easily tolerated.

At the very beginning it is necessary to emphasize one factor which makes accurate evaluation of this treatment extremely difficult. There has been considerable publicity regarding chlorin treatment in the lay papers. The patient, therefore, comes to the clinic with an exaggerated idea of the efficiency of the treatment, and in order to insure admission to future free treatment he feels compelled to say that he has improved when the clinical findings do not bear this out. The psychology of the patient, therefore, has to be taken into consideration and due allowance made. There is also room for considerable variation in statistics owing

TABLE 1.—*Tabulation of Cases by End-Results*

	Patients Treated	Cured	Improved	Unimproved	Made Worse
Acute rhinitis	32	0	24	8	0
Acute laryngitis	14	5	8	1	0
Acute rhinopharyngitis	11	2	6	1	0
Subacute rhinitis	2	0	2	0	0
Subacute rhinopharyngitis	3	1	2	0	0
Acute bronchitis	2	0	2	0	0
Pertussis	5	0	4	1	0
Chronic rhinitis	41	0	20	17	4
Chronic pharyngitis	24	0	10	12	2
Chronic laryngitis	11	0	8	3	0
Chronic rhinopharyngitis	25	0	15	9	1
Chronic bronchitis	27	0	11	16	0
Hay fever	13	0	3	3	7
Asthma	6	0	0	0	6
Suspected tuberculosis	2	0	0	0	2
Empyema of antrum	2	0	0	2	0
Totals	220	8	115	75	22
Percentage	100	3.6	52.2	34	10

to the types of patients treated. In the clinic where these experiments have been conducted, patients with the worst types of chronic conditions have been admitted. Therefore, the experimentation conducted by us would not be expected to show as high a percentage of improvement or cures as would be obtained with a group of more vigorous men who had good resistance.

Treatments were given only once in some instances and in others were repeated at intervals of twenty-four hours for several days. The concentration of gas was also varied somewhat. In general, the concentration was increased almost to the limit of tolerance, which proved to be a concentration of 0.015 mg. per liter as a general rule but on very favorable days somewhat higher.

Table 1 shows that in asthmatic patients the treatment is contraindicated; our experience being that, following treatment, these patients suffered an attack which was, in some instances, very disturbing. Epinephrin injections were used to relieve these attacks.

In hay-fever and in all allergy cases, the treatment caused an increase of symptoms with distinct discomfort to the patient, and these patients were unable to stand even the concentration tolerated by the average patient.

Tuberculosis, according to our observation, is made worse so far as subjective symptoms are concerned. In suspected tuberculosis there is an attack of coughing induced which easily might disseminate the causative organism, making an active lesion from a quiescent focus.

Our tabulation of whooping cough patients was not satisfactory. Five patients have been treated, one of which was definitely unimproved and four did not return for treatment, having had quite bad paroxysms during the administration of the gas. On follow-up, these patients reported an improved condition but they could not be induced to return for a second treatment.

FINDINGS

On examination, the findings in the acute diseases of the upper respiratory tract were: shrinking of the mucous membrane, diminution of discharge, relief of irritation and freer breathing manifest immediately after treatment. This result lasted only a few hours. In the acute laryngeal cases there was a sensation of marked relief following the treatment.

Patients with chronic respiratory diseases complained of an irritation in the chest for several hours after the treatment. A productive cough was evident, after which the patient had a few hours of relief. There was also an increase in the nasal discharge. Following the treatment the patients stated that they rested better at night. This relief was only temporary, and a great number of patients returned a week or more after a series of treatments to report no permanent improvement. Practically all patients, from two to ten hours after exposure to the gas, felt fatigued and drowsy. This fatigue possibly accounts for the improved rest on the night following the treatment.

Patients with upper respiratory diseases were improved, but the extension of the process into the lungs and trachea was not perceptibly influenced. The workers in the clinic experienced an irritation of the nose, throat and lungs which developed into laryngitis and tracheitis. On this account it is unwise for the physician to remain for a protracted period of time in the same room where patients are being treated.

The larger percentage of patients with an acute condition treated had what is commonly termed "summer colds." These, of course, are largely of short duration and self limiting. This feature of so-called cures must be taken into consideration when the statistics are studied.

In these acute types of respiratory diseases, the first twenty-four hours after the treatment usually brings an increase in symptoms; this, of course, following the temporary, short period of relief immediately after the treatment.

TABLE 2.—*Result of Treatments with Interval of Twenty-Four or Forty-Eight Hours*

Diagnosis	Treatment	Patients Treated	Made Worse	No Improvement	Doubtful Improvement	Slight Improvement	Moderate Improvement	Much Improved	Cured
Acute rhinitis	1st	31	2	6	6	8	4	5	..
	2d	21	3	3	3	6	3	3	..
	3d	15	..	1	2	5	3	4	..
	4th	2	..	..	..	..	1	1	..
Acute laryngitis	1st	13	..	1	1	3	2	5	1
	2d	12	..	..	..	1	4	7	..
	3d	9	..	..	..	..	1	4	4
Acute rhinopharyngitis	1st	10	..	3	1	2	1	3	..
	2d	7	..	2	..	2	1	2	..
	3d	6	..	..	..	1	2	1	2
Subacute rhinopharyngitis	1st	4	1	..	1	1	..	1	..
	2d	4	..	..	..	1	2	1	..
	3d	3	..	.	..	1	..	1	1
	4th	1	..	..	.	..	..	1	..
Acute bronchitis	1st	2	..	..	1	..	1	..	..
	2d	2	..	..	..	2	..	..	..
	3d	1	..	..	..		1	..	..
Hay fever	1st	13	7	2	..	3	1	..	..
	2d	8	3	..	3	2	..	..	..
	3d	5	2	..	..	1	1	1	..
Chronic rhinitis	1st	28	..	12	5	10	1	..	..
	2d	15	..	2	4	7	2	..	..
	3d	11	2	2	..	3	2	2	..
	4th	5	1	1	..	1	1	1	..
Chronic pharyngitis	1st	10	..	4	1	5	..	..	..
	2d	5	1	..	1	2	..	1	..
	3d	3	1	2	..	..	..	..	..
	4th	1	..	1	..	..	..	..	..
	5th	1	..	1	..	..	..	..	..
	6th	1	..	1	.	..	..	..	..
Chronic laryngitis	1st	7	..	3	1	3	..	..	..
	2d	6	..	2	1	2	1	..	..
	3d	5	..	1	..	2	2	..	..
	4th	1	..	..	..	..	1	..	..
	5th	1	..	..	..	..	1	..	..
	6th	1	..	.	..	..	1	..	..
Chronic rhinopharyngitis	1st	15	2	3	1	6	2	1	..
	2d	13	..	1	3	6	2	1	..
	3d	10	..	2	..	5	1	2	..
	4th	5	1	..	..	3	1	..	.
	5th	3	..	1	..	1	1	..	.
	6th	2	..	..	..	1	..	1	.
	7th	1	..	..	.	1	..	..	.
Chronic bronchitis	1st	23	9	4	..	7	2	1	..
	2d	11	..	3	1	5	1	1	..
	3d	9	..	2	..	3	3	1	..
	4th	6	..	..	1	..	4	1	..
	5th	5	..	1	.	..	3	1	..
	6th	3	.	..	..	1	1	1	..
	7th	2	..	.	..	2	..	..	..
	8th	1	..	..	..	..	1	..	..
	9th	1	..	..	..	..	1	..	..

All the patients utilized in this study had been subjected to a careful rhinolaryngologic examination and, in some instances, a physical examination to determine the diagnosis of the general condition. In the first group of cases, each patient applying to the clinic for treatment was accepted and received treatment. Later, patients with nasal deformities.

deflection of the septum, diseased tonsils and adenoids, sinusitis and various other obvious correctable conditions were excluded. Patients with chronic conditions were allowed to take as many treatments as they desired and, as our records will show, a large percentage stopped of their own accord because they were not improved by the treatments. Also a large number of patients did not come back following the first treatment. We attempted a follow-up on these and received only a few responses. It seems fair to assume that if a patient had been greatly relieved he would have been glad to answer our inquiries.

TABLE 3.—*Result of Treatments with Interval of From Three to Ten Days*

Diagnosis	Treatment	Patients Treated	Made Worse	No Improvement	Doubtful Improvement	Slight Improvement	Moderate Improvement	Much Improved	Cured
Acute laryngitis	1st	1	..	..	1	..	..	..	..
	2d	1	..	1	..	..	..	..	..
	3d	1	..	..	1	..	..	..	..
Acute rhinopharyngitis	1st	1	..	..	..	..	1	..	..
	2d	1	..	..	..	..	1	..	..
	3d	1	..	..	..	..	..	..	1
Subacute rhinitis	1st	1	..	..	..	..	..	1	..
	2d	1	..	..	..	..	..	1	..
Whooping cough	1st	5	1	1	3	..	..	..	..
	2d	1	..	..	..	1	..	..	..
	3d	1	..	..	..	1	..	..	..
	4th	1	..	..	..	..	1	..	..
Chronic rhinitis	1st	16	2	3	1	9	1	..	..
	2d	15	2	3	1	6	3	..	..
	3d	10	1	1	2	3	3	..	..
Chronic pharyngitis	1st	14	1	5	2	3	2	1	..
	2d	14	1	2	2	7	1	1	..
	3d	9	..	4	2	3	..	..	..
Chronic laryngitis	1st	4	..	2	..	2	..	..	..
	2d	4	..	2	..	2	..	..	..
	3d	3	..	2	..	1	..	..	..
	4th	2	..	1	..	..	..	1	..
Chronic rhinopharyngitis	1st	10	2	5	..	2	..	1	..
	2d	10	1	4	2	3	..	..	..
	3d	6	1	2	2	1	..	..	..
Chronic bronchitis	1st	4	..	3	..	1	..	..	..
	2d	4	..	2	..	2	..	..	..
	3d	3	..	1	1	1	..	..	..
	4th	1	..	1	..	..	..	..	..
Asthma	1st	6	5	1	..	..	..	..	..
	2d	1	1	..	..	..	..	..	..
Chronic nasal sinusitis	1st	2	..	2	..	..	..	..	..
	2d	2	..	2	..	..	..	..	..
	3d	2	..	2	..	..	..	..	..
	4th	1	..	1	..	..	..	..	..
Suspected tuberculosis	1st	2	2	..	..	..	..	..	..
	2d	1	1	..	..	..	..	..	..

CONCLUSIONS

1. There is an improvement in the acute cases involving the upper respiratory tract. We find this improvement more marked if the treatment is given on consecutive days.

2. There is a germicidal action for certain bacteria specified in the laboratory report.

3. In asthmatic patients, allergy and tuberculous patients, chlorin treatment is contraindicated.

4. Our whooping cough patients were too few to permit conclusions, but we feel they were not markedly benefited.

5. Chlorinated air has no alleviating effect on patients with free pus in the nose or rhinopharynx.

6. As a sterilization of the field of operation for nose and throat conditions, chlorin is not sufficiently germicidal in the dilution tolerated to be of benefit.

7. As a prophylaxis for acute respiratory epidemics, our experience has been insufficient to permit conclusions.

8. In 106 treatments, where the bacteriologic findings were compared with the clinical results, there was agreement in sixty-seven cases, or 65.1 per cent., and disagreement in thirty-nine cases, or 34.9 per cent.

Since the bacteriologic and clinical findings agreed in the larger percentage of cases, we feel convinced that our deductions are made on a comparatively accurate basis.

BACTERIOLOGIC STUDY OF THE NASOPHARYNX IN PATIENTS TREATED WITH CHLORIN INHALATIONS *

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The present study was undertaken in connection with the clinical test of chlorin as a therapeutic agent in disease of the upper respiratory tract, reported by Dr. M. F. Jones and Dr. Charles Garofalo.

The general plan of the work permitted the patients to breath air containing chlorin while seated in a specially prepared room. The chlorin was liberated into the air from a pressure tank through an instrument which measured the quantity delivered by displacement of water.[1] In addition, the air in the room was subjected to analysis to determine the actual concentration of chlorin present at frequent intervals during the treatment. In general, the sensations experienced by the patients do give some criterion as to the concentration of the chlorin, but a more precise analytic control is regarded as desirable. Even those who are working every day with this treatment are unable to tell accurately the concentration of chlorin by the sensations which they experience.

In the beginning, two methods of obtaining specimens for bacteriologic examination were given primary consideration: first, the technic of West, in which a sample of the mucus of the nasopharynx is obtained by means of a protected swab introduced through the mouth; second,

TABLE 1.—*The Results of Mass Culture of the Nasopharyngeal Mucus on Twenty-Five Patients Before and After Treatment with Chlorin, the Samples of Mucus Being Taken by Two Methods*

Method	Reduced Growth		Increased Growth		Same Amount of Growth	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
Straight swab	13	52	5	20	7	28
West tube	12	48	4	16	9	36

the sampling of the mucus of the nasopharynx by means of a straight swab passed along the floor of the nasal fossa to the posterior pharyngeal wall without protection. Twenty-five patients were examined by both of these methods. The results of examination are shown in Table 1.

* From the Department of Laboratories, New York Post-Graduate Medical School and Hospital.

1. This apparatus is manufactured by Wallace and Tiernan, New York.

The figures show a slightly higher percentage of change in the tests made with the straight swab, but on the whole there is very little difference in the results by the two methods. The West tube, however, was selected as the method of choice for the subsequent work, because it seemed reasonable to expect a much better sample of mucus from the nasopharynx when it is obtained by this method. It is difficult to introduce a large instrument along the floor of the nose and almost impossible to avoid the intermingling of microbes from the vestibule of the nose or from the respiratory region of the nasal fossa when this method is employed. In inoculating the plates, only the material on the tip of the swab was introduced into the culture mediums.

The medium used throughout the experiments was nutrient agar prepared from beef, 0.5 to 1 per cent. acid to phenolphthalein, to which citrated rabbit's blood had been added, approximately one part of blood to ten of agar. The mucus was swabbed over the entire surface of the solidified medium. Apparently Vedder and Sawyer [2] employed agar without the addition of blood, although they mention obtaining luxuriant growth of such organisms as meningococcus and pneumococcus. In obtaining the specimen, each patient was removed to a special room, free from chlorin, where the specimen was taken before treatment, and again within five minutes after the patient had left the chlorin atmosphere. All cultures were examined after twenty-four hours incubation at 37 C. (98.6 F.), at which time those taken before treatment were compared with those taken after treatment and a record of the comparative quantity of growth was made. The cultures were incubated for another day, and at the end of the forty-eight hour period a record was made of the gross quantity of growth and of the different kinds of colonies, classified as: (1) green, (2) hemolytic, (3) staphyloccus-like and (4) diphtheroid, this classification of colonies being checked by the microscope when necessary.

In a total number of 184 tests, the growth on the after-treatment plate was less in eighty-eight instances, or 48 per cent. of the total. In forty-three instances, or 24 per cent., the after-treatment plate showed more growth than the control. In fifty-three instances, or 28 per cent., there was no obvious difference. In these experiments the chlorin concentration was very nearly 0.015 mg. per liter of air, and the patients were in the treatment chamber for one hour in each case. With regard to the different types of organisms the green producing colonies were diminished or eradicated on the after-treatment plates in twenty-nine instances. They were increased in thirty instances and not perceptibly altered in quantity in forty-eight instances. With regard to this group,

2. Vedder, Edward B., and Sawyer, Harold P.: Chlorin as a Therapeutic Agent in Certain Respiratory Diseases, J. A. M. A. **82**:764 (March 8) 1924.

then, there appears to be an increase as often as there is diminution. Microbes of this type were recognized on the plates in 107 of the 184 tests. The hemolytic group showed a reduction on the after-treatment plates in eleven instances, an increase in four instances and no perceptible difference in twelve. Here the preponderant change is in the direction of reduction, which may be ascribed to the treatment. The staphylococcus-like organisms were reduced in thirty-eight instances, increased in twenty-six and not perceptibly altered in fifty-four, out of a total of 118 instances in which these microbes were observed. The diphtheroids were reduced in ten instances, increased in five and not perceptibly changed in nine. Those instances in which a particular kind of colony was observed on the second plate without being present on the first, are recorded here as instances of increase. Obviously, such results may represent the effect of chance sampling.

It is impossible to avoid variation in obtaining samples from the nasopharynx. In this work, however, all the specimens were obtained by the same person with great care to employ a uniform technic. It is possible that the increased secretion of mucus sometimes present following the chlorin inhalation, especially in chronic nasopharyngeal disease, may have altered the distribution of microbes on the mucous membrane studied.

As a check on the work with the patients, pure cultures of bacteria commonly found in the nasopharynx were exposed to the chlorin gas in the treatment chamber at concentrations of 0.015 and 0.02 mg. of chlorin per liter of air. In this work, the surfaces of blood agar plates were seeded from fresh broth cultures and the plates were then exposed to the chlorinated air for various periods and were then incubated for twenty-four hours. For each microbe eight such plates were employed, exposed face up in the treatment chamber with the cover entirely removed for various fifteen minute intervals up to two hours. A second set of eight plates similarly prepared were exposed in the same way, but were kept moist by spraying with sterile salt solution at intervals of approximately fifteen minutes during the period of exposure.

These moist plates were exposed to the chlorin in the inverted position and tilted at an angle, the edge of the plate resting on the cover. In this way, any excess of fluid was drained off into the inverted cover on which the plate rested. At the end of two hours both sets of plates were placed in the incubator. After twenty-four hours, subcultures into nutrient broth or other special mediums were made and these incubated further for final identification. These cultures were subsequently examined with the microscope and if they remained negative for three days were considered to be sterile. In each instance a control plate culture not exposed to the chlorin was allowed to stand unopened at room tem-

perature for two hours and then incubated with the test plates. In all instances the control plate gave good growth. The results are shown in Tables 2 and 3.

TABLE 2.—*The Effect of Exposure to Chlorinated Air, Containing 0.015 mg. of Chlorin Per Liter, on Plate Cultures of Various Microbes Commonly Found in the Nasopharynx*

	Dry Plates Exposed Face Up, Minutes								Sprayed Plates Exposed Open Inverted, Minutes							
Organisms	15	30	45	60	75	90	105	120	15	30	45	60	75	90	105	120
Streptococcus—Beta	+	+	+	+	−	−	−	−	+	+	+	+	+	+	+	−
Streptococcus—Alpha	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Streptococcus—Gamma	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
Pneumococcus I	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pneumococcus II	+	+	+	+	−	−	−	−	+	+	+	+	+	+	+	+
Pneumococcus III	+	+	+	+	+	−	−	−	+	+	+	+	+	+	+	+
Pneumococcus IV	+	+	−	−	−	−	−	−	+	+	+	+	+	+	−	−
Pfeiffer—Strain I	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pfeiffer—Strain III	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
B. xerosis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
B. hofmanni	+	+	+	+	+	+	+	−	+	+	+	+	+	+	+	+

TABLE 3.—*The Effect of Exposure to Chlorinated Air, Containing 0.02 mg. of Chlorin Per Liter, on Plate Cultures of Various Microbes Commonly Found in the Nasopharynx*

	Dry Plates Exposed Face Up, Minutes								Sprayed Plates Exposed Open Inverted, Minutes							
Organisms	15	30	45	60	75	90	105	120	15	30	45	60	75	90	105	120
Streptococcus—Beta	+	+	+	−	−	−	−	−	+	+	+	+	+	+	−	−
Streptococcus—Alpha	+	+	+	+	−	−	−	−	+	+	+	+	+	+	+	+
Streptococcus—Gamma	+	+	+	−	−	−	−	−	+	+	+	+	+	+	−	−
Pneumococcus I	+	+	−	−	−	−	−	−	+	+	+	+	+	+	+	−
Pneumococcus II	+	+	+	−	−	−	−	−	+	+	+	+	+	−	−	−
Pneumococcus III	+	+	+	+	+	−	−	−	+	+	+	+	+	+	+	−
Pneumococcus IV	+	+	−	−	−	−	−	−	+	+	+	+	+	+	−	−
Pfeiffer—Strain I	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pfeiffer—Strain III	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−
B. xerosis	+	+	+	+	+	+	+	−	+	+	+	+	+	+	+	+
B. hofmanni	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

From the results shown in these tables it would appear that the chlorin concentration of 0.015 mg. per liter has prevented the subsequent growth of the plates exposed for the period of an hour in some instances, but the Pfeiffer bacilli and some of the streptococci and pneumococci were still capable of growth on such plates. In general, the plates which were kept moist with salt solution permitted the survival of the bacteria better than those which were not sprayed, so it may be that the drying of the plate plays some part in preventing the subsequent growth. However, even in the plates which were kept moistened, growth was sometimes inhibited after long exposure. In the plates exposed to the higher concentration of chlorin there is a distinct indication of a more speedy inhibitory effect, although even here the effect at the end of an hour is

hardly perceptible. The question of contamination has to be considered when culture plates are exposed in this way, but the exposure of uninoculated plates in the test chamber as a control, showed that very few colonies would appear, three or four at most, some of which were identified as *Bacillus subtilis* and others as staphylococcus. Similar plates were exposed in the examining room, and on these from twenty to thirty colonies developed after exposure for one hour. It would, therefore, appear that air contamination has been of no importance.

In order to compare the effect of the lower and higher concentration of chlorin and also to compare the plain agar plate with the results obtained with blood agar, a series of ten patients was cultured before and after treatment with the gas at a concentration of 0.015, the plain agar plates being used and the mucus spread over an area 3 by 3 cm., total area 9 sq. cm. In this series, four tests showed reduced growth, four an increase in growth after treatment and in two there was no visible difference. In another group of ten, a chlorin concentration of 0.02 mg. per liter was employed and the same bacteriologic technic followed. Here there was reduced growth in seven instances and in three there appeared to be no effect. A further group of thirteen patients was treated for one hour with chlorin gas, 0.02 mg. per liter, and the cultures before and after treatment were made on blood agar plates by inoculation of the entire plate surface with mucus of the nasopharynx. In seven instances there was reduction in the quantity of growth, and in three the growth was increased after treatment. In three there was no appreciable difference observed.

In addition to the tests which have been made in relation to the chlorin chamber, a brief study of the effect of a machine designed for the treatment of an individual patient has been carried out. In this apparatus the chlorin is generated by electrolysis, the rate of production being controlled by an electric rheostat. A motor driven blower forces air through the instrument at the rate of from 10 to 12 cubic feet per minute, and there are meters to indicate the rate of liberation of chlorin and rate of air flow, so that the concentration of chlorin per liter of air may readily be adjusted. Sterile blood agar plates and plain agar plates were exposed at the open end of the paper delivery tube, or mask, of this instrument for a period of one hour at a chlorin concentration of 0.02 mg. per liter of air. These plates remained sterile after incubation for three days, which would indicate that the air coming from the instrument is probably sterile at the place where it is intended to enter the respiratory passages of the patient. Plates inoculated with pure cultures of various bacteria similar to those shown in Tables 2 and 3 were exposed to the air at the opening of the mask in a similar way for a period of one hour, the chlorin concentration being 0.02 mg. per liter.

Control cultures were made in all instances and kept in the general laboratory for the same length of time. The results are shown in Table 4.

TABLE 4.—*Effect of Chlorin, Produced in the Individual Chlorin Machine, on Pure Cultures of Bacteria*

	Exposed One Hour at 0.02 Mg.	Control
Streptococcus—Alpha	Negative	Positive
Streptococcus—Gamma	Negative	Positive
Pneumococcus I.	Negative	Positive
Pneumococcus II	Negative	Positive
Pneumococcus III	Negative	Positive
Pneumococcus IV	Negative	Positive
B. hofmanni	Positive	Positive
B. xerosis	Positive	Positive

SUMMARY

1. Patients breathing an atmosphere containing 0.015 mg. chlorin for a period of one hour showed some alteration of the microbic flora of the nasopharynx, chiefly in the direction of diminution in quantity of bacteria, affecting more especially the hemolytic streptococci and the diphtheroids.

2. Blood agar plates inoculated with pure cultures of some common pharyngeal bacteria, and then exposed in an atmosphere containing 0.015 mg. chlorin per liter for various intervals up to 120 minutes, showed very little or no effect of the gas on the subsequent development of the bacteria, except in the plates exposed for more than ninety minutes.

3. A chlorin concentration of 0.020 mg. per liter of air gave a distinctly more appreciable reduction in the bacteria of the nasopharyngeal mucus in the patients, and exhibited a distinctly greater inhibitory effect on the plate cultures exposed to it.

4. The bacteria suspended in the air itself appear to be very largely destroyed by the chlorin.

CONCLUSIONS

1. Sterilization of the respiratory mucous membrane by inhalation of chlorin in a concentration of 0.015 to 0.020 mg. per liter of air for an hour or two is not to be expected.

2. The concentrations of chlorin used do exert an effect, however, and often this may be in the direction of microbe reduction, of possible assistance to the body defenses in combating superficial infection.

3. Although chlorin inhalation is not without possibility of injury, its extensive application to acute superficial respiratory inflammations, under suitable scientific control, appears justified in the light of the laboratory studies. The ultimate decision as to its value must be based on extensive clinical trial.

THE TREATMENT OF PAPILLOMA OF THE LARYNX BY FULGURATION AND DIATHERMY*

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AND

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The clinical reports of laryngologists on the surgery of papilloma of the larynx give evidence that the methods in practice have not reached that stage of perfection which warrants standardization of technic. In fact, laryngeal pathology in this line is in a rather confused state. Ideal results cannot be claimed for any particular method. It would appear that we have hitherto been satisfied with restoration of the respiratory function with more or less imperfect phonation.

Our attention has been directed to this work by observation of results achieved in urology in the treatment of papilloma of the bladder, certainly a comparable type of surgery, and presenting similar problems. The pathology and natural history of papilloma of the bladder has been thoroughly studied and the treatment standardized in an exemplary manner. This ideal is eradication without perceptible trauma or scar formation. Dermatologists treat skin neoplasms of similar nature with like precision, and here again we find useful teachings in the line of pathology.

Of course we realize that the restoration of normal phonation to the larynx out of commission for periods varying from months to many years is quite an undertaking, and cannot always be realized, but the point is that it is a proper stimulus to set a high ideal and concentrate our efforts to that end. Perfect phonation means without strain or irritation, and this gives confidence in a permanent cure.

Without venturing a review of the pathology of papilloma of the larynx it is proper to outline the essential teachings of today that we may establish surgical indications and avoid bad practices. We have under consideration a type of neoplasm that belongs to the benign group, a surface reduplication of epithelial nature, of the same class as verruca vulgaris. In fact the term "laryngeal wart" is used by pathologists. It seems best to adhere to the term papilloma, although we may admit the histologic identity and accept the pathology of dermatology for clinical application as we do that of urology.

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*Read at the meeting of the American Laryngological Association, Swampscott, Mass., June 3, 1924.

First comes the question of potential malignancy. Geraghty (Cabot, Modern Urology) classifies papilloma of the bladder as benign or malignant, the latter merging into the papillary carcinoma type. The term potential malignancy implies a possible malignant tendency not detectable by gross appearances, no distinctive surface features, in fact, it can be determined only by serial section examinations. This would seem to settle the old controversy of degeneration into malignancy, which is ever before laryngology. (The literature on bladder ailments would frighten us if we did not realize that we are dealing with two distinct types as to cancer tendency ages. Many of our patients are children and the ones referred to in the literature adults. Urologists consider papilloma of the bladder more than 50 per cent. malignant.) All of this has a special bearing on the surgery of papilloma of the larynx, and especially in adults, it being the opinion of pathologists (Ewing quoted), that partial removal of papilloma by avulsion, curet, snare or knife may actually determine direction of proliferation into deeper tissue and precipitate malignant activity. In other words, convert a benign or borderline neoplasm into a papillary carcinoma.

And now a word concerning verruca vulgaris. Wile's [1] report quotes Judassohn to the effect that he succeeded in transplanting warts on the skin in thirty-one out of seventy-four experiments. Kingery, in Wile's clinic, transplanted warts about six times, more or less typical reproduction. They both report a tendency toward spontaneous cure.

Wile's final conclusion is of interest to laryngologists: "Without denying that it is still possible that localized hyperkeratosis resembling verruca may be due to trauma or foreign bodies, it is definitely demonstrated that such changes can be caused by a filterable virus. It is not unlikely that when trauma or foreign bodies apparently are present as inciting factors, they may merely represent the point of entrance of an infectious agent, as has been determined in these experiments."

As to transplantation, we have evidence of contact reproduction. That occurs in most of our patients, and we know that even a slight abrasion of a part remote from the tumor, such as the upper part of the epiglottis, is liable to be the site of a new growth. In the bladder there is nearly always a contact or "daughter wart" as it is called. Many of us who have treated laryngeal papilloma have developed finger warts, and we certainly may accept the ancient idea of domestic pathology that warts are communicable by contact.

It is scarcely necessary to go over symptoms and special characteristics of laryngeal papilloma, nor will the subject of differential diagnosis be attempted. As to the age that subjects are liable to papilloma,

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1. Wile, Udo J., and Kingery, Lyle B.: Etiology of Common Warts, J. A. M. A. **73**:970 (Sept. 27) 1919.

the fact is that many of our patients are young children, and at this age we encounter the crisis of dyspnea in acute form. The record that most of them have had a prolonged course of asthma treatment tells the story of insidious development. We are inclined to believe that some of them do have attacks of spasmodic asthma due to laryngeal reflex. A slowly progressive dyspnea, even to a very severe type, may be tolerated over a long period. When such patients present themselves for relief, the first step is tracheotomy, as a rule by local anesthesia. In very nervous children with fair respiration it is well to give light ether anesthesia to prevent fear of pain which makes subsequent management of the tube troublesome. A rather low incision is preferred, the main object being to have the tube nestle neatly into the trachea. Hygienic care, the toilet of the neck dressing, and a perfectly clean tube at all times are essential to conditioning the patient for early operation. Usually this can be done in from five to seven days after tracheotomy. In adults, the indication for tracheotomy is dyspnea of severity that makes anesthesia impractical and we must always allow for a postoperative but transient edema.

Now that we have outlined the essentials having a bearing on rational surgery, we will take up the methods of treatment and operations with brief comments. They may be grouped as follows:

1. Tracheotomy, with a hopeful attitude toward spontaneous cure.
2. Surgical avulsion by curet, snare, forceps or knife.
3. Destruction by escharotics.
4. Radium, fulguration and diathermy.

(Internal medication and "wart cures" are covered by the beforementioned "attitude.")

1. Just what physiologic whim determines spontaneous cure is beyond speculation. The credulous ascribe magic to the charm, and not rarely the doctor comes in for his share of credit as a charmer. But our dear art is entitled to know how it was done and the magicians have not yet divulged the secret. So much for treatment Number 1.

2. Many cures are recorded by avulsion methods. Laryngology has an honorable record. But there are too many failures if we accept the critical standard of normal function. Judged by the previous condition, aphonia, dyspnea, physical decline and all considered, even a fair result, good respiration and more or less dysphonia, is creditable work. Compilation of data along this line is impractical and hence comparative statistics are not available.

3. Escharotic treatment has a fair record of successes but it is not popular and we may infer from this fact that the results are too uncertain.

4. Radium. This is right in line with the teachings of the surgical pathology of papilloma. Dr. New of the Rochester Clinic has a good report; seventeen cases followed up. Analysis of his cases would not be conclusive at the date of his publication, and he will probably present his own conclusions. The fact is that radium is not practical except in institutional work and is available to a very few. So we will dismiss further comment on radium treatment with the commendation that it fulfils the surgical requirements.

We have used fulguration for five or six years in treatment of papilloma of the larynx, but prior to 1923, in combination with surgical removal; that is, amputation by snare, forceps or ring curet, and fulguration of the base. Many of these patients show good results, in fact only one was a lamentable failure. This boy grows papillomas like Canada thistles. The damage was not done by fulguration but was due to a series of unfortunate complications, including a foreign body aspiration, bronchopneumonia with pulmonary abscess, and a hopelessly unhygienic home environment, so it would not be worth while to report the case in detail. Several of the patients undergoing operations were adults having fibropapilloma, and in such the combined method, amputation and fulguration of the base is probably the best. As we improve the technic and range of efficiency of the high frequency bloodless method, there will be less occasion for surgical removal. Some of these patients have scar tissue and we are not particularly proud of the phonation results. One such as the failure before mentioned is a stimulus to improve the method.

We are indebted to a confrère, Dr. John Keller, urologist, for object lessons in the treatment of papilloma and assistance in management of the first three patients in which we followed the teachings of the bladder surgeons. To put it concisely, papilloma must be destroyed by a bloodless method. The very juices of the neoplasm may be the agency of transplantation. We have had this experience; thorough removal by forceps and curet through the large tubular spatula. The lower larynx was clean, but two weeks later a crop of papillomas had grown, covering the upper surface of the epiglottis where the tip of the tubular spatula impinged. They were entirely destroyed by trichloracetic acid. A good result but the lesson of transplantation was very clear.

Fulguration and diathermy. Killian-Lynch suspension, ordinary flat table, under deep anesthesia, is advised. Our anesthetist, Dr. C. E. Price, has worked out the technic of this apparently hazardous procedure. It requires experience to get the patient down into the third stage, complicated by the very fact that the breathing organ is out of order. Direct administration through the tracheal cannula requires caution and good judgment.

All of this work has been done with the patient anesthetized and suspended with the Killian-Lynch apparatus for direct laryngoscopy. The spatula used should not be long enough to come in contact with any of the papillomas. If the larynx is full, a good exposure can be obtained by placing the spatula in the glosso-epiglottic region.

The anesthetic used has been ether. The patient is deeply anesthetized before the spatula is introduced and the anesthetic is continued through the tracheotomy tube or mouth during the adjustment of the apparatus to get a good exposure of the larynx. Everything being ready the anesthetic is discontinued. The ether can and mask are taken from the room and anything, coverings or dressings, that may contain ether are changed. The window is opened and an electric fan forces a current of air over the patient for a few minutes. (The fan should be at some distance from the table.) The active electrode is then introduced and the current turned on gradually until the desired results are obtained. If the mass is large the electrode is actually plunged into it, near the base if possible, before the current is turned on. As the amount of current is increased the area round the electrode will be seen to turn pale and later to boil. At this point the current is cut off and the same thing is repeated in other tumors until all have been treated. With smaller masses contact alone is sufficient and renders the injury of normal structures less probable. Since this can be accomplished in a very short time the initial anesthesia has been found to be quite sufficient.

The combination of ether and an electric spark is not without danger. In order to induce and maintain anesthesia with ether there must be a concentration of from 3 to 6 per cent. The lowest concentration at which ether will explode is around 4 per cent. Assuming these figures correct, it is logical to conclude that, when the beforementioned precautions are taken, the concentration of ether in the air passages at the time a spark is likely to occur is not great enough to cause an explosion. In our experience of thirty or more operations such a thing has not occurred. However, it does impress one as being near the borderline and this should stimulate vigilance and caution.

Both the small and the large Wappler high frequency machines have been used. The former has the advantage of being portable, but the latter is better suited for an institution because it is capable of doing heavier work. The inactive electrode is connected to pole 1 and the active electrode to pole 2. The inactive pole consists of a piece of lead foil about 8 inches (20 cm.) square. A larger piece could and should be used for heavier work. This is placed under the patient's back in such a way as to make a good, even contact. The active electrode consists of a small rigid rod insulated with rubber tubing

and set in a suitable hard rubber handle. (Mueller has perfected such an electrode.) It has been found that bending the exposed tip to an angle of about 45 degrees helps in placing it more accurately. This tip is sharp enough to penetrate the tissue easily.

Preoperative Precaution.—In order to be sure the machine is working properly and to determine the amount of current that will be necessary, a piece of raw meat is placed on the inactive electrode, the active electrode is stuck into the meat for a short distance and the current gradually turned on. When a certain amount of current is used over a given length of time the meat near the active electrode will begin to take on a cooked appearance and if continued long enough, will actually boil or char. This amount of current and depth of penetration is noted and used as a guide when working in the larynx.

The monopolar method (no pad or ground wire) was used in the earlier cases, the fulguration spark causing deep charring of the tumors. A mass as large as a peach stone sloughed down to the size of a pea in a week. This brings up the comparison of fulguration (sparking) and diathermy (heating) results and we are not prepared to decide. It is all a matter of producing coagulation necrosis. The idea is to hit the main artery of the pedicle. After the large masses have sloughed away the final step is to attack cautiously the base of the pedicle.

Diathermy produces a marked hyperemia and even edema during the application. This passes off promptly. It is quite the rule to have patients back to normal in a few hours after the operation with no dysphagia nor sore throat. One adult had a pinched tongue which developed a small abscess near the tip. It did not complicate recovery. The maximum of shrinkage takes place in two or three weeks.

CASE REPORTS

CASE 1.—D. R., a girl, aged 13 years, was referred by Dr. Abell of Canton, Ohio, in August, 1923. At the age of 5, the patient was treated for asthma and taken to Utah. A tonsillectomy was performed at the age of 5½. Intubation was first tried to relieve dyspnea and tracheotomy soon after. Several operations, which gave temporary relief, were performed for the removal of papillomas. Occasionally a wart was coughed out but the patient was not able to phonate at all for more than nine years, and had not dared to abandon the tracheotomy cannula at any time.

Physical examination disclosed a well developed girl, and laryngeal examination showed one large firm tumor and small ones visible below it. The ball valve action prevented any air entering through the larynx.

Fulguration was done, September 7, a Killian-Lynch suspension apparatus being used. A thorough charring of the large mass and several small ones was done, the monopolar type of apparatus and an extemporized aluminum electrode, insulated by rubber tubing, being used. Three days later the charred tissue had

sloughed away and the patient phonated for the first time in nine years. But this was evidently a vibration of contact tumor masses and not produced by the vocal cords as subsequent observations proved, but it strengthened her morale and made her anxious for the finishing operation. At this time no papilloma was visible except during phonation. Three weeks later (September 24) she was again suspended and the larynx being fairly open each mass could be reached and properly desiccated, that is, bleached and shrunken by direct spark. There was no voice after this operation but the larynx cleared up, the cords came out clean white bands, and we then discovered the cause of aphonia. There was an old dense scar mass at the anterior commissure which kept the cords from approximating. October 8, two weeks after the second operation, a rather large tumor mass was seen flapping through the glottis on attempted phonation. This was fulgurated at the base, and five days later the patient had a clean larynx except for a small bud below the left vocal cord. This was fulgurated a month later and the tracheotomy cannula removed, after nine years of tubal existence. Then there was a perfectly clean larynx but the patient could not produce a sound when seen in December. The tracheal fistula was almost closed and she was working hard to train the cords to function. This was accomplished a few weeks later and we had hopes of a voice. The scar tissue had evidently existed since some of the early avulsion operations. We hear from her monthly and her physician reports a perfectly clean larynx and steadily improving voice.

Comment.—A larynx overflowing with papillomas for a period of nine years was operated on. There were four fulgurations between September 7 and November 11, a period of about eight weeks. The results are very promising.

Case 2.—D. B., a girl, aged 9 years, was referred by Dr. Abell, Sept. 18, 1923. She had local fame as a singer but became very hoarse six or seven months previously, following what seemed a bad cold. She was treated for asthma but the dyspnea became so severe that loss of sleep and malnutrition had reduced the patient to a critical condition. Local anesthesia tracheotomy was done and tonic treatment given for five days. The slight fever vanished and with normal sleep, strength was restored.

September 25, suspension laryngoscopy under ether anesthesia was done. One large papilloma showed above the epiglottis and smaller ones could be seen below. Fulguration, monopolar method, to the extent of charring and dessicating all tumor tissue visible resulted in sloughing of several masses in a few days. Laryngeal respiration was noted in about a week.

October 2, suspension and thorough fulguration was done, the individual tumors being defined. This resulted in sloughing of masses and one month later there was only a small granular node below the left vocal cord. The cannula was removed, the patient did not tolerate it well, partly because the tube was not kept clean around the shield and it seemed best to risk removal.

Two months later, that is, less than ten weeks from the first operation there was a perfectly clean larynx. The patient had a normal singing voice. About this time she developed a wart of rough granular type on the skin over the elbow, which was removel by nitric acid. Now nearly eight months have elapsed without a suspicious symptom and her physician reports a normal larynx. Both of these patients lived about two hundred miles from Toledo, and we were handicapped by lack of intimate supervision and consequent delays between operations.

Case 3.—C. T. H., a man, aged 46, developed hoarseness from August 23 to October 10, at which latter date he was first seen. The patient was of a robust, vigorous type, but came of a family having a marked susceptibility to tuberculosis. He had a high blood pressure, over 160, and as there was a general hyperemia and edema of the larynx he was put on absolute rest treat-

ment and low protein diet for a month. This was carried out rigorously, and gradually the larynx improved, the vocal cords came out clean except for a discrete papilloma occupying the posterior half of the right vocal cord and below it. The voice was still very hoarse. The blood pressure came down to systolic 137, diastolic 90 and the patient was operated on by ether suspension on November 11. The discrete mass was fulgurated and in two weeks he had a normal singing voice without a trace of roughness.

Inspection during suspension showed a typical papilloma and the prompt cure certainly justifies this kind of treatment. There is another phase to this type of case. The age of the patient naturally brought up the question of incipient malignancy. This kind of treatment, prompt eradication by a method which produces no trauma to underlying tissue, may be considered harmless decisive surgery. With experience, one can gauge very accurately the depth of destruction even on a vocal cord, and if there is recurrence with the usual symptoms of deep involvement of musculature the timely radical operation (laryngectomy) must be considered.

This leads up to a report of a case which emphasizes this particular point.

CASE 4.—M. A. H., a man, aged 57, was seen July 26, 1923. He presented a history of psychasthenic type and had had one severe attack of colitis. These items are mentioned to impress the fact that he was a difficult patient to manage and further, his occupation, that of a traveling salesman touring long distances always by automobile, summer and winter, rarely by rail, subjected him to unusual dust irritation and voice strain.

He was a heavy eater and had a blood pressure of 160 systolic, 100 diastolic. All laboratory tests were negative. The patient had an extreme degree of hoarseness for three months. Local treatment, rest so far as it was practical, and iodid medication was tried for two weeks. The lesion was an infiltration mass, involving the anterior half of the right vocal cord and presenting a surface appearance below like a diffuse papilloma.

The patient readily consented to operation as he was incapacitated for business, and August 8, by suspension, the region was fulgurated by the monopolar method. He was back again on the road in about two weeks, with a voice of fairly good quality and improving. On November 2, he seemed on the way to complete cure. There was still a small nodule in the anterior commissure. Three weeks later there was an acute exacerbation after severe exposure, with pharyngitis and some inflammatory edema, the general symptoms of an acute infection. In two weeks it was evident that there was recurrence of the infiltration and he was again suspended. Examination showed extension of the growth downward. This was fulgurated but we were quite convinced that it was malignant. This operation cleared up the larynx for a short time only; as the hoarseness persisted he was sent to Dr. John E. Mackenty for opinion. The rapid recurrence and evidence of deep involvement were factors in his diagnosis, and the patient consented to laryngectomy. He returned to his home in a month and was back at work a few weeks later. Dr. Mackenty reported laryngectomy for squamous celled epithelioma. This man is today in excellent condition, his morale good, and he has been at work for three months.

The case is detailed up to a certain point to bring out the virtue of this kind of treatment. Suspension and fulguration or diathermy in this class of cases offers not only a method of accurate study of a neoplasm and thorough treatment; it also has the virtue of being harmless so far as transplantation or mutilation is concerned. Recurrence and deep extension indicate malignancy. The method makes possible

timely decision and without transgressing the *noli me tangere* teaching on neoplasms having potential malignancy. It may be labeled the bloodless decisive method.

Two boys, aged 3, are under treatment for complete obstructing papillomas of the larynx necessitating tracheotomy. Each of them has had three fulguration treatments, the voices coming back and the papillomas shrinking satisfactorily.

SOME ASPECTS OF THE PROBLEM OF THE TESTING OF AUDITION, WITH DEMONSTRATION OF A NEW PORTABLE APPARATUS *

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The methods generally used by practicing otologists for the testing of acuity of hearing are better known to the members of this Society in general than to myself, a physicist.

In the realm of physics, until recently experiments in acoustics have been performed chiefly by the use of tuning forks and of vibrating columns of air, such as organ pipes and whistles. The tuning fork is quite a dependable tool so far as constancy of pitch is concerned. As for intensity, this decreases from the maximum in logarithmic fashion, and cannot be controlled, even the attempts at maintaining a constant intensity by the use of make and break electrical contacts being in general unsatisfactory. With the organ pipes, a constant intensity may be maintained, but control of the intensity in any desired manner is not possible. With neither of these types of instruments, can all possible tones be obtained, as one tuning fork or one organ pipe will give one note and the next one in the series must of necessity have a definite measurable pitch difference. They are, however, much more flexible and controllable as regards pitch than as regards intensity.

The ideal source of sound from the standpoint of the physicist would be one in which the pitch could be changed continuously from the lowest to the highest tones desired, holding constant at any pitch the operator wished, the absolute pitch being known at all points and in which the intensity could be similarly known, and varied continuously over a wide range, or held constant, and in which any given conditions of pitch and intensity could be reproduced accurately at any time.

PITCH

This ideal source of sound can now be approximated as closely as is desired by the use of electrical oscillation circuits and electrical control of the resultant currents, in association with something like a telephone receiver which will turn electrical energy into sound energy. The invention of the vacuum tube, such as is used in modern radio apparatus is what makes this possible. A vacuum tube is an amplifier of electrical

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* Read before the American Laryngological, Rhinological and Otological Society, St. Louis, May 30, 1924.

* From the Riverbank Laboratories.

oscillations, that is, the output is greater than the input, so if a part of the output is used to keep the input supplied, the electrical oscillations will persist indefinitely. The frequency of the electrical oscillations of such an arrangement is governed by the electrical quantities capacity and inductance of the circuit, these being quite analogous to the stiffness and the mass of a tuning fork.

If we stick a piece of wax on the end of a tuning fork, the pitch will be lowered. If we could imagine the mass of the prongs of a tuning fork being varied at will while the fork was vibrating, we can see that the pitch of the fork would be correspondingly varied. Such a variation in the mass of a fork could not be accomplished practically, but in the electrical case an exactly analogous variation can be made by changes of inductance of the oscillating circuit, thus varying the frequency of the alternating currents produced. Or we could imagine the frequency of the tuning fork being varied by changing the stiffness of the vibrating prong. This also cannot be accomplished practically, but in the electrical case the analogous condition is the variation of the electrical capacity and this can easily be done. In the audible range, frequency changes of the electrical oscillator by discrete steps are in general most easily made by changing the electrical capacity of the oscillator circuit, while continuous changes of frequency, that is sweeps over a considerable frequency range, are usually more easily accomplished by variations in the inductance. A continuous frequency change over a range of somewhat more than an octave may be made by these inductance changes, while various ranges may be selected by changes of capacity. These points may be illustrated by the piece of apparatus exhibited. This contains a vacuum tube oscillator, which produces alternating electrical currents and these currents are put through a loud speaker which translates the electrical energy into sound energy. The oscillations are started by turning on the currents. One of the dials changes the electrical capacity in the oscillator circuit and so changes the frequency of the tone produced. This oscillator is also equipped with means for varying the inductance of the oscillator circuit and this also changes the pitch of the note heard. The inductance is arranged to give a tone with a continuous variation of pitch, while the capacity here gives changes by something like an octave. This oscillator will give frequencies from about 200 to 6,000 cycles per second. So far as the vacuum tube oscillator in general is concerned, if equipped with the proper inductances and capacities, it will function at 1 cycle per second as well as at 1,000,000 per second, the latter being the frequency used by a radio station broadcasting on a 300 meter wave length, the electrical oscillations for the broadcasting station being generated in an exactly similar maner to that of this oscillator, and being governed or tuned by the values of inductance and capacity used. So we have all of the control over the frequency which we wish.

REGULATION OF INTENSITY

As for intensity regulation, it is very easily accomplished, for electrical currents are easily controlled by means of electrical resistances. From the value of the resistances introduced into a circuit if properly arranged, it is possible to calculate the reduction made in the current, and also the reduction in the sound intensity given out by a receiver attached to the circuit. Thus in this instrument, a switch controls the electrical resistances in the circuit and these resistances are so arranged and are of such values that each step of the dial produces a reduction in intensity of the sound of a factor of 10. Thus starting with quite a loud sound, the next sound will be of one-tenth the intensity, the next one-tenth of the last or one-hundredth of the original, again one-tenth, another one-tenth, etc.

An auxiliary key produces a change of intensity of a little over 3, two such steps equaling a change of 10. Now it would be quite possible to produce a gradual change in intensity from the loudest point down to zero intensity, instead of the discrete steps which this apparatus gives. This is merely a matter of convenience in the using of the apparatus and in the calculation of the exact intensity changes produced. As for the possible ranges in intensity, sounds have been produced by the use of vacuum tubes as amplifiers, which could be heard more than a mile away, while on the other hand it is possible to reduce the intensity of the sounds to a point below minimum audibility. So we see that by the use of vacuum tubes, it is perfectly possible to produce a sound of any pitch desired and of any intensity within the bounds of reason, and to exercise perfect control over both of these factors, pitch and intensity. From the standpoint of the experimental physicist working in acoustics this is a great advance, and it should also be a matter of considerable importance to the otologist interested in the production and control of tones for the testing of acuity.

For the transformation of electrical energy into sound energy, the most obvious instrument to use is a telephone receiver. There is another type of instrument, however, which has some advantages over the telephone receiver and likewise some disadvantages. This is the thermophone, the action of which is extremely simple. It consists of a very thin strip of platinum foil through which the alternating current passes. The current heats the platinum strip and this heats the adjacent air which expands, producing the condensation portion of a sound wave. As the current alternates, so the heating and also the air condensations are periodic and a sound is thus produced. With such a strip, contained perhaps in a small telephone receiver case and held to the ear, it is possible to calculate the pressure of the sound waves on the ear drum. It has the disadvantage that it requires an auxiliary direct current and also it is in general not efficient enough for use with people who are very

deaf. However I have tested the acuity of hearing of a number of presumably normal people [1] and the results of a few of them are shown.

REVIEW OF ACUITY OF HEARING IN SEVEN PERSONS

Chart 1.—This represents sensitivity of hearing as a function of frequency. By making calculations of sound intensities from the theory of the thermophone, the values of sensitivity are given in absolute units. Thus a value of 7 of sensitivity means that the minimum audible sound has an intensity of 10^{-7} ergs per square centimeter per second, 8 represents 10^{-8} etc., so that a difference of 1 in sensitivity means a ratio of 10 in intensity. The frequency of the sounds used is shown below, middle C being at about 256, 500 being about an octave above middle C, 1,000 two octaves above, etc. The sensitivities of the two ears of the person are shown. They are quite alike.

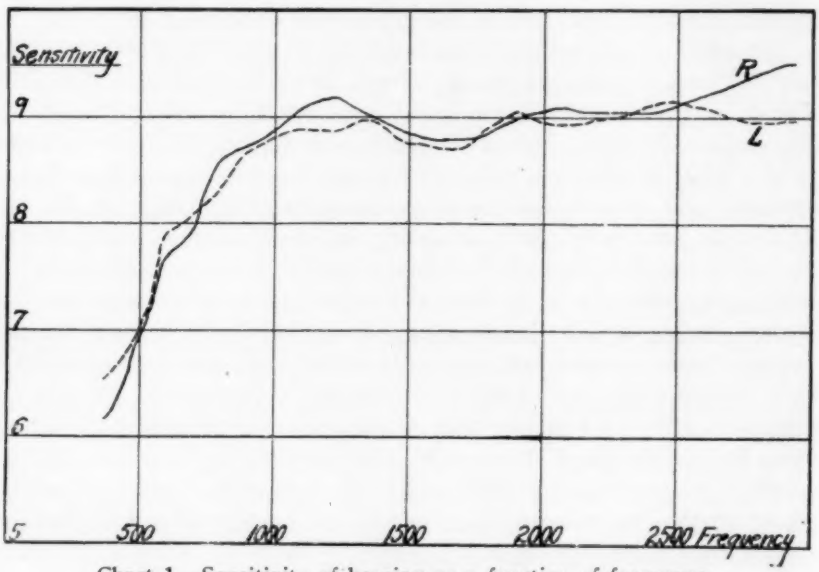

Chart 1.—Sensitivity of hearing as a function of frequency.

Chart 2.—This shows a drop off in sensitivity for one ear around 1,800 cycles per second, nearly three octaves above middle C. In making these tests, the intensity was first made such that the sound was inaudible over the whole of a frequency range which could be covered by the variation of the inductance in the oscillator, say between 1,000 and 2,000 cycles per second. The frequency was under the control of the subject, so that he could slide it up and down until satisfied whether he heard or not. As the intensity was increased, the subject in general heard part of the range before other parts. If he were particularly sensitive over a part of the range, he would hear this portion first as the sound became louder, while if he were deficient over a part of the range, this portion would be heard last as the intensity was increased. Thus for the left ear of this person, between 1,000 and 2,000 cycles, the middle portion of this range appeared first, and by the time the sound was loud enough to be heard at all at 2,000, it was at 1,700, ten times as loud as was necessary

1. Kranz, F. W.: Physical Rev. **22**:66-72 (July) 1923.

for audition. The changes in intensity for these determinations were made in intensity steps of 2, that is, each level of intensity had twice the energy of the preceding. In this method of a continuous change in pitch, as compared with testing separated pitches, there is the advantage that it leaves no uncertainty as to the conditions existing in between pitches. The comment has been put forth that in testing with discrete jumps in intensity, there is an uncertainty in the location of the minimum sound, dependent on the size of the jumps and that this uncertainty is just as objectionable as making tests with discrete jumps in frequency without knowing what occurs in between. It seem to me that this point is not at all well taken, for a variation by an intensity factor of 2 or 3 in the location of the low limit of audition is of no consequence either from a practical standpoint of hearing or as a factor in the theories of audition, while the ear may have characteristics which are of great significance which may be missed altogether by tests taken at separated frequencies.

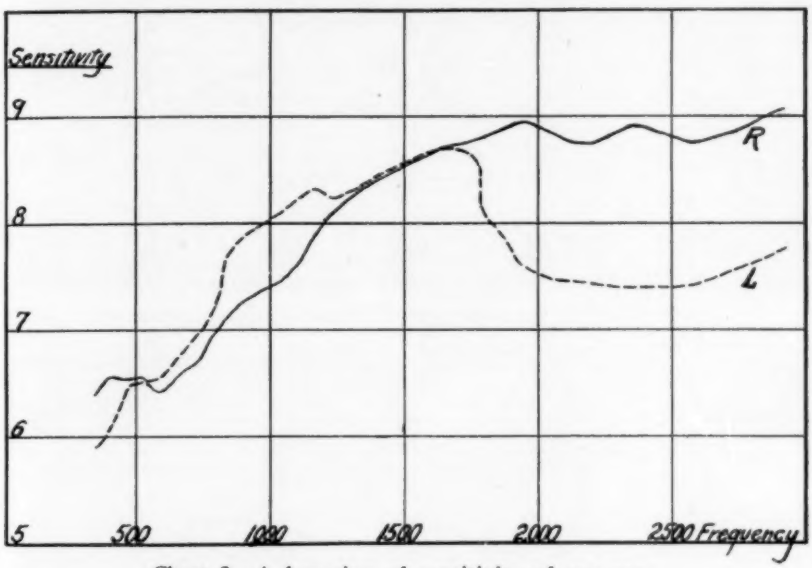

Chart 2.—A lowering of sensitivity of one ear.

For instance, if tests were taken at 1,000, 2,000 and perhaps 3,000 cycles per second, the exact location of the minimum audibility at these points would probably not give as useful or significant information as would their location within a factor of 2 or 3 in intensity plus the information that the hearing fell off at about 1,800 cycles per second. The sliding frequency method amounts to taking horizontal sections of the curve or determining the intersections with horizontal lines. The method of test at discrete frequencies amounts to determining the intersections with vertical lines, and from the very nature of the curve there can be only one intersection with one vertical line and the curve cannot be determined so completely in this fashion. Drs. Seashore, Dean and Bunch have used the principle of the sliding frequency in their rotating audiometer.

Chart 3.—This chart illustrates the advantage of the continuous frequency change. The existence of this narrow deficiency would in all probability never be discovered if tests were to be made at separated frequencies, and if discovered, the sharpness of the drop off could be investigated only with very great difficulty.

Chart 4.—Here too, there is a deficiency over a limited frequency range. The sensitivity drops by 3 or the necessary intensity for audition changes by a factor of 10 to the third power or 1,000, in a change of pitch of about a

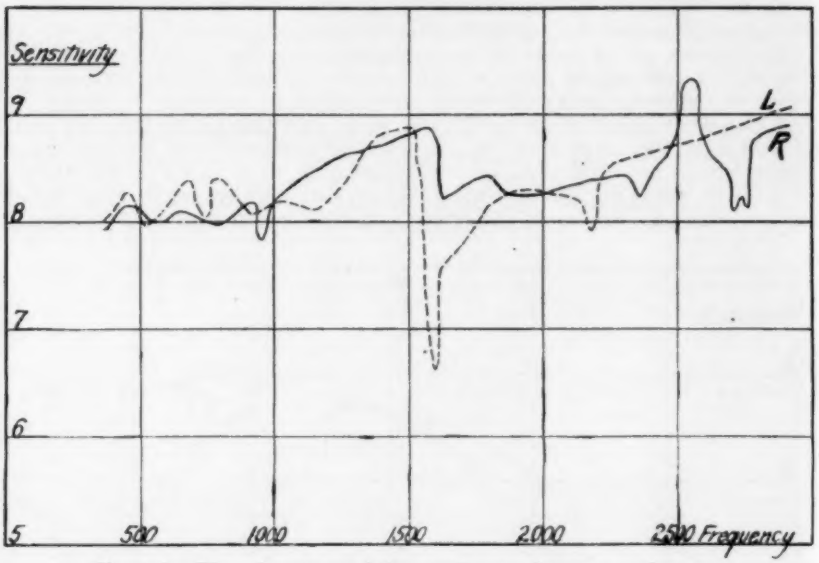

Chart 3.—The advantage of the continuous frequency change.

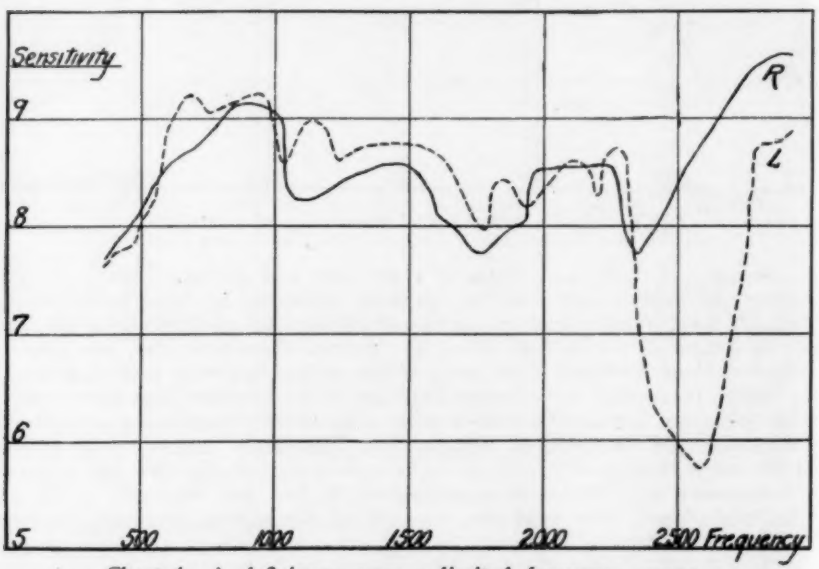

Chart 4.—A deficiency over a limited frequency range.

semitone. This would undoubtedly be totally missed by the method of tests with separated frequencies. It may be that this dip has no practical significance. This happens to be my own left ear, and I am certainly not conscious of its

being defective in acuity. Yet the existence of this dip and its sharpness are of distinct significance as regards theories of hearing, for they must be explained by an acceptable theory. I have found in my tests of a rather limited number

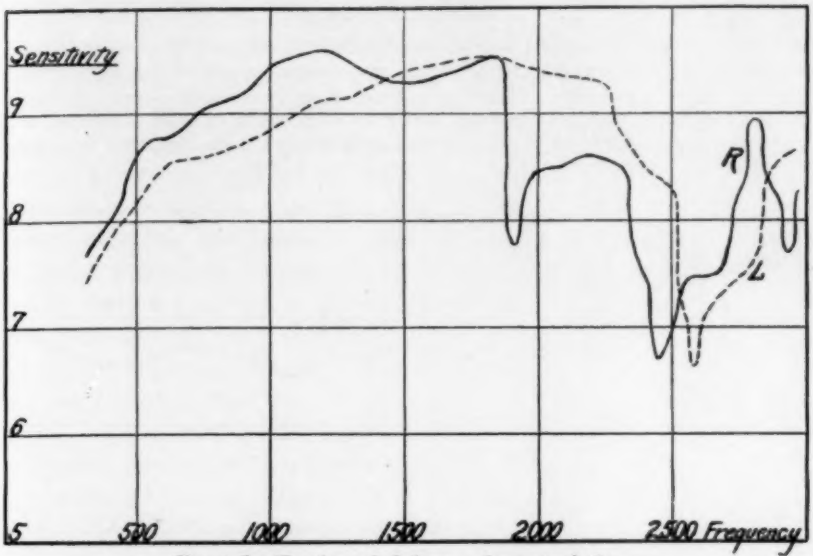

Chart 5.—Further deficiency characteristics.

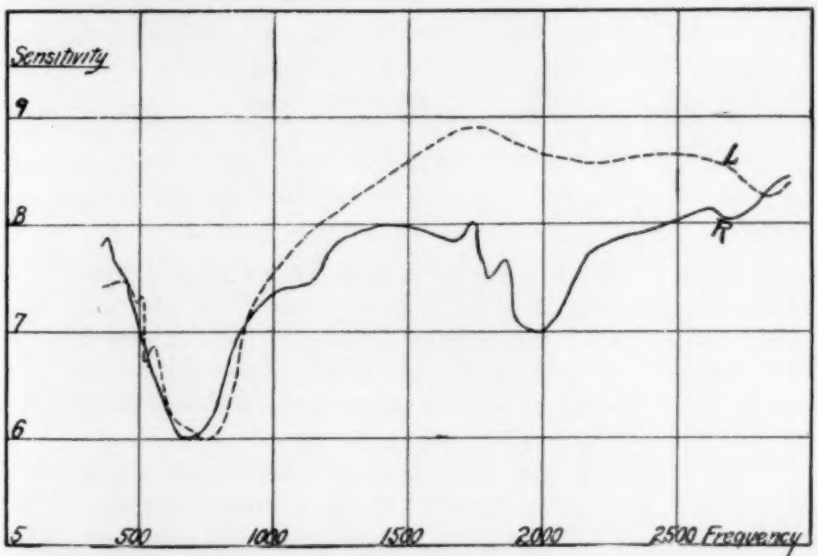

Chart 6.—A deficiency at low frequency, about equal for both ears.

of subjects that a deficiency in this region seems to be the most common defect of supposedly normal hearing people, and I was interested to note that Bunch[2]

2. Bunch, C. C.: Ann. Otol., Rhinol. & Laryngol. (June) 1923.

working with a rather large average group has stated this as his conclusion also. These dips are very easily located by use of the sliding frequency.

Chart 5.—This shows other characteristics.

Chart 6.—This shows a deficiency at low frequency, about equal for the two ears.

Chart 7.—This shows the average of about thirty ears, all of them presumably of normal acuity. As for the absolute magnitudes involved, the amplitude of the vibrating air particles at the higher frequencies is as small as one-thousandth of one-millionth of a centimeter, about one thirtieth of the diameter of a molecule, really quite small, that is, the ear is really a very sensitive instrument.

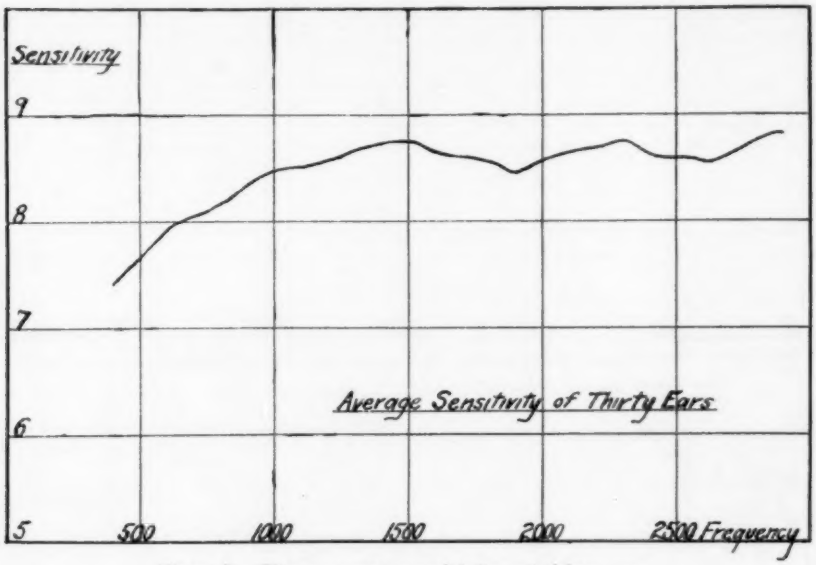

Chart 7.—The average sensitivity of thirty ears.

COMMENT

It seems that the best way to indicate the acuity of a person is by means of a curve, on the order of those shown. The units used being absolute units are not dependent on a particular piece of apparatus. A more efficient instrument, as a telephone receiver would be more practicable for the testing of deaf people than the thermophone, and this could be calibrated in absolute units by a comparison.

There have been some attempts to express the acuity of a person by a single number, say a percentage of a normal hearing. If this number is obtained from a curve of acuity somewhat like those shown, the question immediately arises as to the limits of frequency it is necessary to consider. The upper limit of human audibility is in the neighborhood of 20,000 cycles per second, but it is quite probable that many people have been born, have lived and have died without even having

been exposed to a frequency near this limit. The highest note on a piano is about 4,000 cycles per second, and this is about the limit in music. As for the practical speech range, it is considered by telephone engineers to be from about 200 to 2,000 cycles per second.[3]

In many of the long distance telephone lines, frequencies above 2,000 cycles are eliminated by electric filters and the quality of the talk over these lines is perfectly satisfactory. This means that a person could be totally deaf to all frequencies above 2,000 cycles per second and yet get along very well indeed in conversation, which is what people are actually interested in as regards their hearing. An apparent disagreement with this conclusion is indicated by tests made with isolated syllables which have shown that with all frequencies above 3,000 eliminated, there are still some syllables which are not understood correctly, but these tests do not take into consideration the very important factor of context occurring in actual continuous speech. That is, a person does not need at all to hear and identify each and every sound separately in order to understand speech, so that in defining acuity for conversational purposes, the frequencies above 2,000 or perhaps 2,500 cycles can be neglected. A similar differentiation may be made between the low frequency limit for normal people and the low frequency limit necessary for satisfactory understanding of speech. A limit of 200 cycles per second would probably be quite satisfactory for the latter, that is, if a person were totally deaf for all frequencies below 200 cycles a second, he could still get along quite well with conversation. Many other common sounds he would miss. These considerations apply to designating the acuity by a single number or a percentage derived from a curve of acuity as a function of frequency. If this number is to mean anything to the patient, it seems that it should be based on his ability to hear conversation, and it seems that it might better be derived directly from tests with speech delivered to the patient in some manner by which the intensity could be regulated and read. Such a single number for acuity would have a certain usefulness as an indicator of the progress of deafness from time to time, or as an indicator of the benefits of any treatment given, but from the standpoint of diagnosis by an otologist, its value would seem to be limited.

SUMMARY

The general sphere of usefulness of such types of apparatus as these, in the practical testing of deaf subjcts for diagnostic purposes, will of course in the end be determined not by the physicist but by the practicing otologist who will probably base his judgment on the basis of time involved in making the tests, amount of expense and care of

3. Hartley, R. V. L.: Proc. Inst. Radio Eng. **11**:38 (Feb.) 1923.

apparatus, convenience of making tests, new information he can obtain and the possibilities of aiding the patient in the light of the information gained. On the other hand, any new type of apparatus which will yield any kind of new information, or will substitute quantitative for qualitative measurements, provides a means for a better understanding of the process and mechanism of hearing and deafness, and in this direction progress lies.

THE FUNCTIONAL EXAMINATION OF HEARING

ANNUAL SUMMARY ON THE PROBLEMS OF THE DEAF, PAPERS RELATING TO DEAF-MUTISM AND EDUCATION OF DEAF CHILDREN, MECHANICAL DEVICES FOR HEARING, LIP READING, AND SO FORTH

ROBERT SONNENSCHEIN, M.D.

CHICAGO

NOTE. The field of otolaryngology has become so broad, that the man doing this work finds it difficult to follow as he would like the important contributions that are being made along the several lines. For his convenience, the ARCHIVES has undertaken to prepare a series of critical annual summaries which will epitomize the important contributions that appear covering the more important phases of this special field. So far as practical, the reviews on a particular subject are to appear each year in the same month.—THE EDITOR.

Because it is impossible to have the review of the literature for the current year ready for the ARCHIVES by the end of that year, it was thought best to cover the period from about October, 1923, to October, 1924, and similarly for any succeeding years.

At the suggestion of the Editor a few papers on the treatment of deafness, and so forth, have been included in the abstracts.

One cannot expect radically different functional tests to appear at frequent intervals, but a number of valuable and suggestive ideas have been offered during the last year, especially by Runge, Ruttin, Wotzilka and Gatscher.

A NEW AUDITION TEST IN ADVANCED DEAFNESS AND DEAF-MUTISM

Wotzilka[1] records the fact that in 1918 he had systematically examined the acoustic palpebral reflex by means of tests with tuning forks and whistles. In 1920, in another publication, he called attention to the fact that the palpebral reflex could be elicited by means of the harmonica, and that he was also able to obtain this reflex in blind children by snapping the fingers in the vicinity of the external auditory meatus. In order to prevent this reflex by tactile means, he always turned the orifice of the whistle away from the face of the patient. Especially was this true in regard to the reflex with the harmonica which gave definite, that is to say, useable results only when tones are not conducted to the ear by means of a tube and if the examination is carried out in such a manner that the air current is directed away from the ear or the face of the subject. Wotzilka made these tests on a number of children,

1. Wotzilka, Gustav: Monatschr. f. Ohrenh. **57**:880 (Oct.) 1923.

and came to the conclusion that this reflex can be obtained with high tones in patients who, from a practical standpoint, have insufficient remains of hearing, and that, even where there are good "rests" of hearing, this reflex may fail when the lower octaves are used. He concludes therefore that in the examination of the reflex, we may discover ranges of hearing not found by any of the other usual methods. In some cases it is necessary to test the patients with continuous series of forks, in order to find out whether at different pitches there are any remains of hearing. Wotzilka has already called attention to the fact that, by means of this examination, it will probably be much easier to discover remains of hearing in mute children at an earlier age than was previously possible, so that one can start the proper exercises much earlier for the development of those "rests." With the harmonica one obtains a tactile reflex (even from the mouth and forehead branches of the facial nerve) more often than is obtainable by tuning forks, and this is probably due to the fact that the harmonica produces a much more powerful tone. For this reason, the reflex would be elicited much sooner with the deeper tuning forks because the low pitched forks have a greater tone intensity.

It is not entirely clear from Wotzilka's statements whether the test described is that which is commonly known as the aural palpebral reflex. Most of the authorities perform the latter test by means of a high pitched tuning fork (for instance, c^4, 2048 double vibrations) and it has always seemed to us that there is a certain difficulty to be overcome. If there is doubt as to the hearing in both ears, there is very little objection to the test. However, if the hearing in the ear which is not being tested is good, it is very difficult to exclude this ear so that one can be quite certain when the reflex appears that there is actually hearing in the examined ear, and that the sound of the high pitched fork has not been carried over to the opposite or good ear. Especially in small infants is it difficult to use any methods to exclude the opposite ear, since this maneuver alone would serve possibly to attract the infant's attention and therefore make it difficult if not impossible to obtain the proper palpebral reflex from the examined ear. Aside from this feature, of course, this reflex is a most valuable measure to determine whether any remains of hearing are present or not. There is still the question, however, as to the forks employed in this test, since the one which is frequently used is c^4 (2048 double vibrations) which serves only to detect the remnants of hearing for the higher range. As a matter of fact, we know it is the hearing of the middle octaves which is most essential for the understanding of speech, and therefore we quite agree with the author that other forks, especially those in the middle octaves, should also be employed in the endeavor to solve the problem of the presence or absence of remnants of hearing.

A NEW HEARING TEST IN CASES OF FAR ADVANCED DEAFNESS AND DEAF-MUTISM

The article by Froschels [2] is in the nature of a reply to the one of Wotzilka, already quoted. Whether the examination of the reflex with the harmonica only then gives desirable results if the tones are not conducted to the ear by means of a tube, is a question which this new method of examination brought forth, and cannot as yet be definitely answered. He calls attention to the fact that from the study of acoustics we learn that the longitudinal sound waves are transmitted in all directions in the form of a sphere, and therefore even though the opening of the tube or whistle is directed away from his face, these waves will strike the face of the subject who is being tested, and therefore it is impossible to state definitely whether the appreciation is that of the actual sound or whether there is some tactile sensibility aroused which gives the reflex on the part of the patient. Therefore, the only absolutely reliable method as yet is that in which the patient repeats or tries to imitate words or sounds which he hears. We should therefore test children supposedly deaf by means of a long hearing tube, in order to see whether they actually hear the sound, or whether the previously elicited palpebral reflex is due to a tactile and not to an auditory sensation. Often while making the reflex examination, one feels assured that the patient really hears, although he does not definitely imitate the sound that has been produced. Froschels believes the reflex is elicited more by a feeling of the vibration than by actual hearing, for the reason that in many deaf-mutes the reflex is present when tones of one pitch are produced, and is absent with other pitches. Hence these tones (the ones which are heard and those which are not heard) are apt to lie very closely to one another in the scale, and it is not likely that there is such a great difference in the intensity of the sound that one would produce a tactile sensation and the other not. Froschels cites the case of a girl who had been declared deaf, who reacted to repeated examinations with all tones in three octaves but not to the tone of a^1 (435 double vibrations).

It seems to us that while the testing with the aural palpebral reflex is a valuable procedure, it requires still further study (judging from the conflict of opinion between a number of the authorities), in order to determine whether it is really the various sounds that produce the reaction or whether there is also an element of tactile sensibility involved.

LOCALIZATION OF SOUNDS AND THE WEBER TEST

It seems to be the endeavor of Gatscher [3] to see whether there is a definite relationship between certain combinations of the localization of

2. Froschels, Emil: Monatschr. f. Ohrenh. **67**:1038 (Oct.) 1923.
3. Gatscher, S.: Monatschr. f. Ohrenh. **57**:946 (Oct.) 1923.

sound and the Weber test, as well as to see in what manner the two methods can be used as an aid to diagnosis. In the test, this relationship is possible because the Weber test itself is essentially nothing more or less than an examination of whether the tones of the tuning fork can be localized by the person. It is well known that when both ears are normal, the Weber test should be referred to the head; in a typical conduction impairment involvement, the sound of the fork should be referred to the ear which hears worse, whereas in impairment of the perception apparatus, it should be lateralized in the better hearing ear. Sounds heard by air conduction excite to a greater degree that ear which is nearer the source of the sound. This makes it possible for the subject to state from which side the sound is coming. Even when there is a considerable difference in the hearing power of the two ears, it is possible for the worse hearing ear to properly localize the sound if the head is placed in the optimum position with reference to the sound. Only when the hearing ability of this ear is so reduced, that even in this optimum position the other ear is stimulated more powerfully, does error in localization appear. According to the theory of intensity, a source of sound which is placed in the median line of the head sends its waves to both labyrinths, and it will therefore be properly localized in the median line when the ears present the same anatomic and physiologic condition; if there is a difference in the two ears, then the lateralization to one or to the other side will occur.

Gatscher's tests are carried out in the following manner: A Barany noise apparatus is thoroughly wound up, and held at a distance of about 25 cm. either above or behind the head in the median line. The patient must state whether he hears the sound in the middle line above or behind or whether he hears it to the right or left. We know that, as a rule, it is more difficult to lateralize the source of sound in the before-mentioned position than if it lies anteriorly. The author has, however, avoided this position in order to prevent the patient's orientating the sound in that manner. Errors in properly designating the sound as being above or behind have no special significance, since the main object is to see whether there is an apparent localization to one or the other side of the median line. After citing the histories of a number of illustrative cases, Gatscher comes to the following conclusions: With the Weber test alone, it is impossible to make an exact diagnosis. Combining the result of the localization test with the Weber, it is often possible to arrive at a diagnosis in the following manner: (1) If the sound is lateralized both by the localization test and the Weber to the same side, then a disease of the perception apparatus on the opposite side is probably present. (2) If, however, the lateralization of the localization test is on one side and the Weber goes to the opposite side, then it is assumed that there is a dis-

ease of the conduction apparatus on the side to which the Weber goes; and if there is bilateral involvement it is thought that the worse condition is present on the side to which the Weber is lateralized.

While we have recognized for a long time that the Weber test furnishes considerable information in certain cases, there are many instances where it is of only slight importance or where it even gives contradictory results. It has been our opinion that the Weber test is of value, as a rule, only when it agrees with and confirms other findings. For this reason, it is good to have some further corroborative evidence of localization, as described by Gatscher in his test.

THE NEED OF PERFORMING THE RINNE TEST WITH FORKS OF SEVERAL OCTAVES (C, c, c^1, c^2)

Wolff [4] is led to make his communication by the desire to call attention to and correct the idea of using only the a^1 (435 double vibrations) fork for the Rinne test, as laid down by the Eighth International Otological Congress. He quotes Bezold to the effect that performing the Rinne with different forks gives varying results, and that according to the different findings the severity of a conduction apparatus impairment may be judged. Brühl and others stated long ago that the diagnostic value of the Rinne test only then comes to light when a number of forks are used.

If the Rinne is carried out with only one fork (a^1, 435 double vibrations) or c^1 (256 double vibrations) a slight impairment cannot be demonstrated, and the degree of a severe involvement cannot be properly evaluated.

Wolff begins the examination of the Rinne with c (64 double vibrations) first showing the difference between the tactile sensations due to the vibrations and the actual hearing of the fork. If the Rinne is positive for C fork, no higher forks are used, but if it is negative the next higher octaves are tried until we see whether it will become positive or not. No higher pitch than c^2 (512 double vibrations) is ever used, since it would be impossible to tell whether the vibrations of the stem are heard via bone, or the vibrations of the prongs via air. The author finds it best also to do the Weber and Schwabach tests, in order to check up on the bone conduction as found with the Rinne; when employed alone any of the tests will fail in certain cases.

The assertion of Bezold, that in cases of unilateral impairment of hearing or where there is on one side a conduction apparatus involvement and on the other side a nerve deafness, the Rinne does not give decisive findings, really rests on the fact that in such cases the Rinne alone does not suffice for making the diagnosis.

Wolff postulates the following regarding the Rinne test: (1) In normal hearing persons the Rinne is positive for all tuning forks. (2)

4. Wolff, H. I.: Ztschr. f. Hals **6**:168, 1923.

If the Rinne is found to be positive for some one tone, it will never be negative for any higher tone. (3) If the Rinne is decidedly negative for a certain tone, it will never be positive for a similar tone in the next higher octave.

Especially in otosclerosis is the finding of the Rinne test of value, when performed with a number of forks. The author cites a case of this kind which he examined clinically, and after death histologically. He had found Rinne test negative in the right ear up to c^1 (256 double vibrations), in the left ear up to c^2 (512 double vibrations). Histologically, in the right ear impaired mobility of the stapes was seen, and in the left ear bony ankylosis. Wolff says that if in a young subject with negative Rinne test there is a considerable nerve impairment, it means a large progressive focus, and that the prognosis with reference to the hearing is poor. If in considerably older persons the Rinne test is negative as high as c^2 (512 double vibrations) with but little nerve deafness, it probably means a small focus with only slight tendency to extension, and the prognosis for hearing is better.

This paper brings out, or rather emphasizes again, a very important fact with reference to the Rinne test. While we feel that for the majority of cases, testing the Rinne as most otologists do with one medium pitched fork, for instance, c^1 (256 double vibrations) or a^1 (435 double vibrations) is usually sufficient, there is no question that in many instances much more definite information may be had by testing with several forks, in the manner described by Wolff, and long ago advocated as he himself states, by Brühl and others. We must remember that the lower the pitch of the fork, the greater the tendency to get a negative Rinne test.

THE DEMONSTRATION OF THE PRESENCE OF REMAINS OF HEARING

Ruttin [5] bases his work on the use of "beats." He cites Stenger's test, which is made with two similarily pitched forks, and quotes Kreidl and Gatscher's statements that beats arise centrally since forks held before both ears give "beats," whereas they are not heard in cases of unilateral deafness. In the work of Kreidl and Gatscher it required a certain degree of intelligence on the part of the subject to detect the difference. For Ruttin's purpose, this was unnecessary; all that was needed was the observation on the part of the patient that a difference in the tone of the tuning fork was noted.

The test was performed by conducting to the examined ear by means of a piece of tubing the sound of a medium pitched fork (Vienna model), and interrupting this tone by alternately applying and removing the tube;

5. Ruttin, E.: Arch. f. Ohren. **3**:102 (Dec.) 1923.

at the same time a similarly pitched fork is held before the opposite ear at a definite distance. Two variations of this test were likewise employed. First the tone of the tuning fork was conducted by tubing to one ear and frequently interrupted, while a similarly pitched fork was held on the vertex of the skull. Another modification of the test consisted in alternately pressing a tuning fork on the vertex and then removing it, while another fork was held at a definite fixed distance from the opposite ear.

Twelve patients were thus examined and their histories given; eight of these were deaf (as demonstrated by other methods) while four had "rests" of hearing. Ruttin says:

> In all cases of unilateral deafness, the prong of the fork held at the hearing ear or on the head was not changed, when the frequently interrupted tone of another fork was conducted by means of tubing to the deaf ear. The tone was at once changed if instead of this, the second tone was carried by bone conduction when the fork was alternately placed upon and raised from the vertex, the sound being thus frequently interrupted. With these changes in tone the patient exclaims either "The tone is getting louder," "It is getting weaker," or only, "It is changing."

The author says that this method enables one to demonstrate the presence of "rests" or remains of hearing, at least those for the middle octaves.

The theory of this test sounds like a plausible one, and we believe it should be tried out. We should not quibble about words, but it seems to us that the term "Schwebungen" used by Ruttin in his article is possibly not the most happy one to employ. What we understand by "Schwebungen" or "beats" are heard only when two sources of sound, such as two tuning forks, are simultaneously vibrating and if there is any difference in the frequency of the two forks, then there will be that number of beats per second which corresponds to the difference in frequency of the forks; for instance, if a fork of 435 double vibrations and another of 438 double vibrations are sounded at the same time, the ear will perceive three beats per second. Ruttin evidently uses the word "Schwebungen" to mean the impression that the patient gets from the interruption of the sound produced by alternately applying to the ear and removing from it the tube to which the tuning fork is attached. This is purely a technical matter and does not bear on the test which has been described.

CENTRAL DISTURBANCES OF HEARING

This detailed and careful paper by Grahe [6] does not lend itself well to abstracting; only the essentials can be mentioned.

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6. Grahe: Ztschr. f. Hals **6**:498, 1923.

The subjects studied were thoroughly examined with the Bezold-Edelmann series of forks, and the upper tone limit determined with the Struycken monochord. In the quantitative examination with tuning forks, a normal hearing subject was used as a control. Hearing for the whispered voice and for conversation (the latter with noise apparatus in the opposite ear), the Weber, the Schwabach, the Rinne test, and the determination of the upper and lower tone limit was carried out. Grahe divided his findings into the various groups depending on the anatomic location of the lesion.

1. In disease of the nerve trunk there is a typical picture showing: deafness, diminution in hearing for speech; with unilateral involvement the Weber test is lateralized to the well ear; bone conduction (via vertex) with a ^{1} (435 double vibrations) fork is shortened; lower tone limit is elevated; the upper tone limit is variously affected, being normal, slightly or decidedly reduced; the Rinne test is also variable but is usually positive.

2. Disease of the pons and the medulla. Here the picture is quite variable. There is only slight diminution in the perception of speech. Bone conduction is often shortened only with the low pitched fork. The upper and lower tone limits vary considerably and so do the quantitative hearing tests. Where the caudal portion of the medulla is affected, the hearing on the same side is involved whereas in lesions of the frontal part, the disturbance in hearing is bilateral and there is often a greater involvement on the side opposite to that of the medullary lesion.

3. On the side opposite to the lesion midbrain patients show especially a diminution in the hearing for speech, marked shortening of the bone conduction, a reduction of both tone limits beginning in the lower one with later a concentric contraction.

4. Temporal lobe involvement does not show a typical picture. The hearing distance for the voice is only slightly reduced, and bone conduction is often diminished only for the lower pitched forks. The lower tone limit is normal (or slightly elevated), the upper tone limit moderately lowered. The variation in findings, noted in the quantitative curves of hearing, points to a distinct path along separate fibers.

5. In general intracranial processes without direct involvement of the cochlear tract, there is no definite type of hearing involvement.

THE STENGER TEST FOR THE DETECTION OF SIMULATED UNILATERAL TOTAL DEAFNESS

Czubak [7] describes the Stenger test, because it is not usually mentioned in most textbooks. This test is usually made with a pair of

7. Czubak, M. F.: Laryngoscope **33**:921 (Dec.) 1923.

a^1 (435 double vibrations) Edelmann forks which are unweighted and are of exactly the same pitch, so that they will vibrate in resonance (sympathy). The hearing distance of the tone of these forks is so short that a vibrating fork held before one ear cannot be heard by the other ear, even if the latter ear is normal. The principle underlying the test is that if a person is examined with two forks of equal pitch held at equal distance from each ear, he will not be able to lateralize the sound into one or the other ear.

If one fork is held a shorter distance from one ear than from the other, only the nearer fork will be heard because from it will come the more intense sound. As described by Czubak, the test is performed in several steps. First step: Assuming that the examined person simulates total deafness in the right ear, the examiner stands behind the patient, both forks are struck and held at an equal distance from each ear. The patient will state that he hears it only in the left or supposedly good ear. This admission is important and should be noted. Second step: The forks are again sounded and the fork on the patient's left ear is moved farther away. The patient should hear only on his right ear, but he will probably deny that and say he hears only in his left ear, from which the fork should be progressively removed. If the patient is not confused, proceed to the third step: Show the patient the two forks. Strike both and then stand behind him, and smother or silence the fork which is held at the patient's left side. Then the patient is tested as in the second step; he may then say that he hears it in the left ear whereas he is falsifying, as that fork is not vibrating at all. If he admits hearing it in the right ear, the simulation is discovered. If he says he does not hear it at all, proceed to step number four: Strike both forks and hold the left fork 2 inches (5 cm.) from the left or good ear, and the other fork 1 inch (2.5 cm.) from the right or supposedly deaf ear. For the third time in succession, the patient has heard the fork in his right ear. Having answered the previous times that he did not hear at all, he must again do so now. Suddenly the examiner removes the right fork entirely. The patient should hear with his left ear; if he admits he hears it on his left side he falsified the previous times, for if his right ear were deaf, he should have heard with the left ear. If he says he hears nothing, he likewise falsifies, for in the first step he admitted hearing the fork at the same distance as now. If he says he hears it with his right ear, he confesses his malingering and falsifies because there is no fork near his right ear at this time. The author concludes that if during any part of the test, the patient admits hearing with his right ear, his malingering is discovered. If he claims he hears the sound with his left ear in the second and third steps, he eliminates the probability of that reply If he insists he hears no sound, the first and last steps

disprove that statement. If he does not claim absolute deafness, the amount of hearing lost can be estimated roughly by measuring the distances at which the two forks must be held in order to be appreciated in one or the other ear, bearing in mind that the intensity of sound is in inverse ratio to the square of the distance.

We have always felt that the Stenger test was a most valuable one, and has for the most part been given scant attention by otologists and by writers of textbooks, and we are therefore glad that Czubak has called our attention to it again. We are inclined to believe, however, that it is not necessary to make the test as complicated as he has done. It is our experience that when performed in the ordinary way as laid down by Stenger (with the patient blindfolded and thus not knowing that two forks are being used), it is possible to discover any case of simulated total unilateral deafness. Not knowing that the fork is vibrating at a greater distance from the admittedly well ear than it is from the supposedly deaf one, he is bound to give false answers. He dare not admit that he hears the intense sound in the supposedly deaf ear because then he admits his own malingering, and since the sound that is going into the supposedly deaf ear is drowning that being reproduced at equal distance from the supposedly well ear, at which distance he has previously admitted having heard the fork, he will probably say that he does not hear any sound at all. This fact alone at once establishes the fact that he is falsifying. In July, 1923, W. A. Wells published a very simple and practical modification of the Stenger test, wherein he inserted the tuning fork into a piece of rubber tubing, connected it with the ear that was supposedly deaf, and then carried the fork by means of tubing over the head to the opposite ear within the distance at which the patient admitted hearing in his well ear. The sound going into the good ear is "drowned" by the intense sound going through the tube into the supposedly deaf ear.

A DISCUSSION OF BONE CONDUCTION AND A NEW PROCEDURE FOR THE STUDY THEREOF

Runge [8] presents a detailed and painstaking monograph, which discusses the many phases of the subject of bone conduction. Conflicting views of many authors are mentioned, and attention is called to the fact that no clear explanation of the cause of the shortening of bone conduction in various conditions such as syphilis, and so forth, has as yet been offered. On the other hand, there is a consensus of opinion that the more compact the tissue in the long bones, the better

8. Runge, H. G.: Ztschr. f. Hals **5**:289, 1923.

the conduction. In the temporal bone, it has likewise been demonstrated that the dense, compact portions transmit sounds better than do the diploetic or pneumatic.

The author quotes Helmholz and other physicists to the effect that the ossicles vibrate in mass and not by molecular movement.

Attention is called to the fact, known to most otologists, that marked changes in the membrana tympani often give no decided disturbance in hearing.

Bezold's theory is discussed in much detail, and his conclusion quoted: "That only those sound waves going by way of bone conduction can be perceived which can be transmitted to the conduction apparatus and from there reach the labyrinth." Concerning the function in audition of the round window, many conflicting views are presented but no definite conclusion is reached by Runge. The subject of the mechanism of bone conduction is discussed and the craniotympanic theory of Bezold is contrasted with the purely craniolabyrinthine hypothesis of Wittmaack.

Runge presents both the sound "outflow" theory of Mach and the resonance theory of Lucae, but finds they do not explain the phenomenon of lengthened bone conduction. Mention is made of Bezold's well known experiment and statement, that increased tension of the conducting apparatus in any of its parts diminishes the air conduction, but increases bone conduction of sounds. Brüning's theory of a difference in the phase relation between the sounds which reach Corti's organ via air and bone conduction is also stated. After recounting Weber, Rinne, Schwabach and Gellé tests, and pointing out the conflicting views, and also the uncertainty of our knowledge with reference to both the theory and the findings in these tests, the author proceeds to his "water-filling" test.

Runge bends the patient's head to one side and instills 1 c.c. of water into the ear with a record syringe and then tests the bone conduction by placing the tuning fork on the mastoid process. He says: "With normal hearing the bone conduction is about twice as long as when there is no water in the ear." This rule seems to hold for all forks up to c^2 (512 double vibrations) diminishing slightly as this point is reached. The author admits that analogous experiments were made by Wheatstone in 1827, later by Politzer, Lucae and others.

In a series of cases of otosclerosis no lengthening of bone conduction was found when the water filling tests were used. In light cases of otosclerosis where the hearing for the whispered voice was still quite good, a slight prolongation was obtained.

Runge also found no lengthening of bone conduction in his tests after a radical mastoid operation, and describes this fact to extensive adhesions about the stapedial foot plate following the curetting of the tympanic cavity. In cases of cochlear degeneration the bone conduc-

tion, which had been greatly reduced, was usually doubled in length by the water filling tests. In the early and in the final stages of acute otitis media, the bone conduction is diminished with the test as compared with a normal ear; in well developed acute otitis the bone conduction is not increased by the water filling.

He also believes that the increased bone conduction normally present when the ear is filled with water is due to two things, namely: (1) A better transmission of sound to the drum membrane by the fluid, (2) to a diminished "outflow" or escape of sound from the ear; it seems the former is the more important factor.

While Runge holds that bone conduction goes not only by the craniotympanic route, but also by the craniolabyrinthine path, he regards the former as the superior one.

The history and histologic examination of a number of cases are given, in whom the bone conduction had been found lengthened. In none of these cases, however, had the water filling test been tried. From the histologic findings, the author believes that the lengthened bone conduction in many patients is due either to changes in tension of the ossicular ligaments, or to the closer apposition to the tegmen of portions of the ossicular chain, especially that of the head of the malleus.

This interesting article is evidently the result of a great deal of study and investigation on the part of the author. Innumerable references to the literature are cited. The discussion of the many conflicting theories with reference to bone conduction, and the actual research of the author carry much food for thought.

BONE CONDUCTION OF C (64 DOUBLE VIBRATIONS) AND LOWER TONES

In a very brief communication, Josephson [9] states that the C fork (64 double vibrations) when used in testing bone conduction is not heard as such, but that the subject usually hears an overtone, most often c (128 double vibrations). Similar experiences were had with forks of lower tone. The bones and sinuses of the head are said not to resonate to the lower notes but to their overtones.

This is a very interesting statement, and it would perhaps be well to have these tests repeated and to know whether the patients are correct in their assertions that only certain definite overtones are heard and not the fundamental tones.

EXCLUSION OF ONE EAR WHILE EXAMINING THE OTHER

Mauss [10] holds that the insertion of a dry or moist finger in one ear while examining the other does not exclude ordinary sound. This fact is the more pronounced the worse the affected ear happens to be, and the better the occluded ear is. Furthermore, the use of such

9. Josephson, E. M.: Laryngoscope **34**:122 (Feb.) 1924.
10. Mauss, Wilhelm: Klin. Wchnschr. **3**:358 (Feb. 26) 1924.

appliances as the Barany noise apparatus may defeat its purpose in that it interferes with hearing in the ear which is being examined.

Both of these facts have been known by otologists for a long time. The author directs attention to Wagner's "shaking" test, which, however, was used only in connection with tuning forks in the determination of unilateral deafness. Uffenorde (according to Mauss) employs the test as follows:

> The index or middle finger (whether moistened or dry is immaterial) is tightly inserted in the auditory meatus and then a shaking movement produced. With the other hand the patient covers his eyes. If possible to do so, it is better to have an assistant manipulate the ear.

Mauss concludes that the ordinary occlusion of the meatus with dry or moistened finger is of use only in slight degrees of hearing impairment and where the whispered voice is employed. When the shaking or vibratory movements of the finger in the meatus are carried out, there is complete occlusion for the whisper and for moderately loud conversation voice. For higher tones above c^2 (512 double vibrations) the test fails. It is claimed that with the Barany noise apparatus sounds above c^2 (512 double vibrations) are also not excluded, even though they may be heard less intensely because of the loud sound of the noise apparatus; the latter has the further disadvantage that it influences the ear which is being examined, whereas the finger test does not affect the opposite ear. Mauss believes the shaking test is the best yet devised to occlude one ear while testing the other.

We believe that unless the finger of the examiner who manipulates the ear is covered with a sterile finger cot, it might be possible to produce an infection in the auditory meatus during vibratory manipulation. Instead of the shaking test, would not the rubbing of the auricle by the palm of the hand produce just as much of an effect as the noise apparatus?

SPEECH AS THE MOST NATURAL AND BEST HEARING TEST FOR THE GENERAL PRACTITIONER

Lampert [11] dwells on the fact that, for the general practitioner, testing with the voice is the most rational and valuable method in determining the degree of hearing. It is not a question of whether a person can hear a certain definite tone alone but whether he can perceive and understand the combinations of tones found in words. Depending on the principal formants present, the various sounds will be of higher or lower pitch and depending on the location of the lesion, hearing for one or the other type will be affected.

Lampert considers it most important to reduce to a minimum the possibility of guessing words. The ability to combine sounds and formulate words or numbers is great.

11. Lampert, Heinrich: München. med. Wchnschr. **71**:333 (March 14) 1924.

It is inadvisable to use meaningless words, for the subject, if he hears at all, will assume that he is hearing incorrectly, and therefore will answer incorrectly. Lampert suggests that:

> A series of words be used with slight variations of the vowels, in order to see whether the particular consonants to be tested are really heard or vice versa. When properly used, the testing with the voice is a valuable and time conserving differential diagnostic method for the general practitioner.

While testing with the voice is subject to many errors, since it is impossible to use the same intensity at all times, and since the hearing is considerably affected by reflection of sounds by the walls, ceilings and furniture in the room in which the test is carried out, nevertheless the use of the voice often very rapidly gives a fair index of the degree of the impairment of hearing. By using high and low pitched sounds, one can often get a good idea which portion of the ear is involved. While other means of testing are more accurate, nevertheless our estimate of the state of an ear is based on its ability to hear and understand the spoken voice, since that is the medium used in social and business intercourse. It is therefore most important to watch the degree of impairment of hearing of speech.

HEARING IN THE PRESENCE OF A NOISE

Kranz [12] investigated the idea possessed by many people that deaf persons hear better in the presence of a noise. Experiments have shown that certain deaf people can carry on a conversation with normal persons better in the presence of a noise. Kranz' work consisted in using a noise coming from a telephone receiver either held at various distances from the ear (by way of air conduction) or applied to the ear by way of bone conduction. These receivers were actuated by 120 cycle current. The observer used a monotone, repeating the same phrases over and over again. The subject heard no better when in the presence of a noise produced in the receiver than when there was no noise. The determining feature in the ability of some deaf people to hear better in the presence of a noise is, that when conversing with normal persons, the latter raise their voices. The people benefited by noises are usually suffering from middle ear disease, and the ordinary noises are probably of lower frequency than speech. The idea is that such deaf persons are less disturbed by low pitched noises than normal persons.

It has been held by many otologists that the real reason patients with impaired hearing, especially of the otosclerotic type, hear better on trains and in noisy places is that the person with whom they are speaking raises his voice in order that the patient may hear. Alexander of Vienna, however, states that tests have shown that this is not true, but that the subject actually does hear better in a noisy place when the same intensity of speech is used as in ordinary conversation. It is the intense

12. Kranz, F. W.: Ann. Otol., Rhinol. & Laryngol. **33**:283 (March) 1924.

noises and vibrations, especially on a train, which increase the mobility of the stapes and thereby improve the hearing for the lower tones, according to him.

FUNCTIONAL HEARING TESTS IN NORMAL CASES

Bunch [13] tested 164 students, supposedly normal both physically and mentally, of an average age from 18 to 28. Auditory defects were present in a majority of the subjects for tones between 2500 double vibrations and 3100 double vibrations per second. In more advanced subjects there were defects in tones between 1000 and 4000 double vibrations, often without apparent effect on the upper tone limit. There is a distinct correlation in this before-mentioned defect and the loss of acuity of hearing for the whispered voice, and a decrease in perception of time by bone conduction.

Seventy-three per cent. of the subjects tested showed diminished bone conduction, in 56 per cent. of this number the decrease was more than three seconds. The upper tone limit was well under 25,000 double vibrations. The monochord checks up with the other physical tests better than does the Galton whistle or the Koenig rods. All of the cases of lateralized Weber (7 per cent.) had existing pathologic changes or asymmetric conductivity of the cranial bones to account for this finding.

These examinations were made in a climate subject to frequent weather changes. This fact, together with the foregoing findings, would indicate an early involvement of the perception apparatus in many supposedly normal ears.

The author has done a great deal of excellent functional testing of hearing in collaboration with L. W. Dean, and we believe his findings indicate some important points which should be well borne in mind in the examination of patients.

PROBLEMS IN RELATION TO THE HARD OF HEARING

Newhart [14] wishes to present a few facts in regard to the needs of the deafened as they concern the physician, especially the general practitioner. Statistics of draft boards and medical examination in schools show that more than three million people in the United States are so deaf that this impairment interferes with their educational progress, vocation and social relationship. He says that by far the greater number of cases of deafness are preventable.

The author states that the problems of the deafened (as distinguished from deaf-mutes or the congenitally deaf) are grouped as follows: (1) Those pertaining to prophylaxis and treatment of all diseases which cause deafness; (2) those relating to education and rehabilitation of the deaf, and (3) those pertaining to economic and social welfare of the hard of hearing.

13. Bunch, C. C.: Ann. Otol., Rhinol. & Laryngol. **33**:174 (March) 1924.
14. Newhart, H.: Minnesota Med. **6**:405 (June) 1924.

With reference to prophylaxis and treatment, Newhart says that medical students should be better trained to recognize and treat the diseases leading to deafness, and that medical schools should devote more time to teaching this subject. Some of the points of prevention are: (1) Regular routine examination of all persons as to their acuity of hearing; and (2) earliest possible removal of all discoverable pathologic factors which might cause ear diseases. Children in school get this examination which, according to the author, should be extended to all persons in the community. No patient should be told his disease is hopeless until a careful otologic examination has been made. All factors tending to perpetuate an increase in this disability should be removed if possible. Lip reading is a helpful resource; it mitigates the sense of isolation and improves the outlook on life.

Many persons derive help from various electrical devices, radiophones, and so forth, and their development promises much, but no device should be purchased until it has first been tried out.

In many states provision is made for education and vocational training of children, and this should be started at the earliest possible age. In relieving some of the social and economic problems, it is suggested that a special organization should be formed among the deaf to do social service among their own kind. These organizations partake of the nature of a club. An ideal organization consists of (1) an otologist, (2) a social worker, and (3) those with acquired deafness. There should be classes in lip reading, an employment bureau and study clubs.

This paper is full of many good ideas, some of which have already been tried and some which may be developed. In any case it seems to us that every movement which tends to the alleviation of the physical, social and economical difficulties of the hard of hearing should be heartily encouraged.

EDUCATION OF THE DEAF CHILD

All physicians share with teachers, parents and organizations in the community the trust imposed on them in the care of the deaf child. Goldstein [15] also thinks that otolaryngology must include in its field a better understanding of all conditions applying to the deaf child, including an analysis of (1) the type of deafness; (2) the degree of deafness; (3) peculiar psychology of the deaf, and (4) additional methods and possibilities, as well as end-results expected of modern pedagogic methods.

Otolaryngologists must not overlook legislative measures for the benefit of the deaf child. It is also suggested that committees on education in state legislatures should familiarize themselves with the best forms of training for the deaf.

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15. Goldstein, M. A.: New Orleans M. & S. J. **76**:519 (June) 1924.

In large cities, the program is about as follows: special classes in conjunction with public schools, or whole schools set aside for the purpose of instruction and proper methods. The latter would teach a child fluent, flexible, audible speech and make contact with others possible by efficient lip reading. The teaching of the deaf child must begin when very young. There must be more properly trained teachers. Adults who become deaf through accident or disease should be encouraged to take up lip reading. It requires from four to six months of training to make an efficient lip reader.

This is a most important subject, and there is probably no one in the country better able to speak on and for it than Goldstein, who has devoted so many years to study and teaching in this field.

QUANTITATIVE STUDY OF HEARING WITH AND WITHOUT COTTON PLUG PROTHESES IN THE MIDDLE EAR

The authors [16] discuss in detail the points relating to a subject wherein the application of a cotton plug in the external canal increased the auditory acuity. They state that in certain patients such plugs are useful, but that the condition of the middle ear mucosa is a very important factor. They mention a patient of Kerrison's in which the hearing improved when a concomitant swelling of the middle ear mucosa existed; but that when the ear became fairly dry, the deafness increased.

REPORT OF CASE

E. J. V., a man, presented himself at the Mayo Clinic, June, 1918. He had a bilateral otitis media for eighteen years. On the left side a mastoidectomy had been performed shortly after the onset of the trouble with no improvement as regards suppuration from the ear. His hearing was good, the only complaint being the discharge which was aggravated by head colds. Examination of the patient showed a robust man in good condition. The tonsils had been removed; there was a deviation of the nasal septum to the left with nearly complete obstruction. The right ear showed a perforation in the posterior portion of Shrapmell's membrane. Foul pus and cholestrin crystals were found but the hearing was good. In the left ear there were almost the same findings, but the auditory canal was more tortuous. The roentgen-ray picture showed diffuse sclerosis of the cortex with apparent pneumatization. The labyrinthine tests showed normal reaction. The diagnosis was chronic otitis media bilateralis suppurativa with cholesteatoma. All treatment was of no avail. Right radical mastoid operation was performed Jan. 19, 1919, and on the left side, February, 1919. Cholesteatoma was found; convalescence was normal.

The beneficial effect of the cotton plug was discovered quite accidentally, as a plug that was left to control scarring in the middle ear cavity was noticed by the patient to cause the hearing to become worse, and become further reduced when the cavity was allowed to become dry. After reinserting the plug, hearing was improved in a few hours, and when the plug was soaked with mineral oil, the improvement took place sooner.

Treatment with absorbent cotton plugs, 1 cm. long, 0.5 cm. wide. One end was dipped into oil containing 1 per cent. of phenol (carbolic acid). Change in

16. Lillie, H. I., and Kranz, F. W.: Ann. Otol., Rhinol. & Laryngol. **33**:458 (June) 1924.

hearing was immediate on removing or replacing the plug. Hearing improved for some time after inserting the plugs and the latter were changed every week or ten days. A film of mucus is found on them where they come in contact with the promontory.

Tests of the acuity were made with a vacuum tube oscillator: (1) after the oiled plug had been in place for several days; (2) immediately after its removal; (3) two hours after removal; (4) and immediately on reinserting the plug. The next day similar tests were made, except that the plugs were left out for a period of about seven hours. Oscillations of two frequencies were used: (1) 256 to 500 double vibrations per second; (2) 800 to 1500 double vibrations per second. In the second series, an additional frequency range of 2050 to 3400 double vibrations was used.

The authors arrived at the following conclusions: (1) The use of the oiled cotton plug prothesis increased the acuity of hearing in this subject by an intensity factor of from 100 to 1000, over frequency ranges of from 250 to 3400 double vibrations per second. (2) The use of the plug was of some benefit in bone conduction, from 2000 to 3400 double vibrations, but of no benefit for those around 1000. (3) There was no particular effect on acuity due to drying of the ear cavity in the maximal time the plugs were left out, namely: six and a half hours.

It is very interesting, of course, to have a scientific corroboration of the fact so often noted in the use of cotton plugs, especially those dipped in oil and used as artificial drum membranes. Patients may be taught easily to make these plugs and to insert and remove them at proper intervals. It seems to be the experience of a great many otologists that these very simple measures give good results without the disagreeable effects of many of the mechanical artificial drum membranes and other devices which have been recommended for insertion into the ear.

METHODS AND INTERPRETATION OF THE FUNDAMENTAL TESTS OF HEARING

This paper [17] was the result of a talk (illustrated with lantern slides) given before the Section on Instruction of the American Academy of Ophthalmology and Otolaryngology in October, 1923, at Washington, D. C. An effort was made to summarize the principal methods and tests employed used in the functional testing of hearing, and to group tests in as practical a manner as possible.

The summary of the principal hearing tests is somewhat as follows:

1. Observation of the patient to see whether he watches the lips of the speaker, noting the loudness of his voice (usually loud in severe inner ear disease and low in marked middle ear disease), and so forth.

17. Sonnenschein, Robert: Ann. Otol., Rhinol. & Laryngol. **33**: (June) 1924. 1924.

2. Otoscopic examination of the external and middle ear as well as the mastoid region.

3. Nasal, nasopharyngeal and pharyngeal examination.

4. Testing with speech. With the patient's eyes closed or averted and the opposite ear occluded, unaccentuated whisper or conversation used, employing high and low pitched numbers or words or combinations thereof.

5. Inflation with Politzer bag or catheter, and again testing with speech.

6. Tuning fork tests: For the determining of the lower tone limit, from C_2 (16 double vibrations) upward, then continuing a range of forks to c^5 (4096 double vibrations per second). The upper tone limit with the highest forks, also with the Edelmann-Galton whistle, or better still, the monochord.

1. Weber test for lateralization. The fork is placed on the median line of vertex, forehead or over the nose. Normally heard in the vertex. ("In the head"). Usually lateralized in worse hearing ear in conduction apparatus impairment, or if both ears have middle ear affection, sound goes to the worse of the two ears. Usually lateralized in the better ear if disease of perception apparatus is present in the other ear. If both ears have perception impairment, the sound is usually lateralized in the better hearing ear. We must remember that with the Weber referred for instance to the left ear, which has conduction impairment due to an acute otitis media, if there is suddenly a change in lateralization to the right side, it often means that an involvement of the inner ear (labyrinthitis) has occurred on the left side, and the Weber is heard in the opposite or better ear. A sudden change from one side to the other is the important fact.

2. Schwabach test for duration of the bone conduction of the individual as compared with the normal, using living control or comparing with average hearing for the particular fork employed. The fork is usually placed on the median line of vertex or forehead or it may be set on the mastoid. The age of the patient, the thickness of the hair or bones, the manner of application of the forks, firmness of contact with the skull, changes in the dura, and so forth, gives variation in the bone conduction. A definite lengthening of the bone conduction means that there is impairment of the conduction apparatus, while a distinct shortening of bone conduction usually means involvement of the perception apparatus. A decided change in the bone conduction is in many ways the key to diagnosis and prognosis in ear disease.

3. Rinne test for comparison of air with bone conduction in the same person. The stem of the fork is placed on the mastoid (avoiding contact with the auricle), and when no longer heard, the prongs are held

close to (without touching auricle or vibrissae) and parallel with the ear, and the duration of hearing by air noted. Normally the Rinne is two of the indefinite or plus minus type, and the so-called "infinite" varieties of Rinne (two forms of the positive, three varieties of negative, positive (air conduction longer than bone). There are about eight negative where there is no hearing via air with slight hearing via bone.

4. The Gellé test for determining the mobility of the foot-plate of the stapes. Compressing the air in the external auditory meatus gives diminution of hearing in normal subjects by pushing the stapes further into the oval window. If fixation of stapedial foot-plate is present, no change in hearing occurs with increase in air pressure.

5. Stenger test for unmasking simulation of total unilateral deafness. Two forks of exactly the same pitch are used, the patient being unaware that more than one fork is sounding. The fork nearer one ear drowns out the sound of the fork at the other ear.

6. The use of audiometers, resonators, and other appliances is suggested for use in special cases.

NEW METHOD FOR DETERMINATION OF DEFECTIVE HEARING

Michie [18] mentions various standard functional hearing tests such as (1) the whispered voice (using residual air); (2) the spoken voice, using ordinary conversation tone; (3) the "coin click" test, two coins clicked softly at a distance of twenty feet, the person who is being examined counts the clicks out loud; (4) watch test. The ordinary Ingersoll should be heard at about a distance of 40 inches (101 cm.). The watch should be tested previously to determine its normal standard. (5) Tuning forks. (6) Acoumeter. (7) Galton whistle, and so forth. (8) The audiometer developed by the Western Electric Company. The use of the instrument is said to give accurate and constant findings, and does not require an expert for its manipulation. With the exception of the audiometer, there are no new methods mentioned in this article. We believe it is still too early to pass definite judgment on the audiometer, but think it should be thoroughly tried out in the endeavor to see whether it will give satisfactory and uniform results in all cases. We believe, however, that the watch test is a rather unreliable feature, in that no two watches are alike and therefore the findings of one examiner cannot be compared with those of another. Furthermore, the watch produces a variety of noises instead of the regular pure tone which one would derive from a source of sound like a tuning fork. We realize, however, that in many institutions where a large number of patients must be examined in a routine manner, it is impossible to take the time required for a complete test and in those instances an appliance like the ordinary watch will give a rough estimate of the degree of hearing.

18. Michie, H. Clay: Mil. Surg. (July) 1924.

News and Comment

The American Board of Otolaryngology, for whose organization Dr. George E. Shambaugh was responsible, met at his invitation, on November 10 at the University Club of Chicago, for the purpose of organizing a board of directors.

The American Board of Otolaryngology was organized, with the following as members of the first Board of Directors: Dr. H. P. Mosher, Boston, president; Dr. F. R. Spencer, Boulder, Colo., vice-president; Dr. H. W. Loeb, St. Louis, secretary-treasurer; Dr. J. C. Beck, Chicago, Dr. T. E. Carmody, Denver, (absent); Dr. T. H. Halsted, Syracuse, N. Y.; Dr. R. C. Lynch, New Orleans; Dr. B. R. Shurly, Detroit; Dr. R. H. Skillern, Philadelphia, and Dr. W. P. Wherry, Omaha.

The Board of Directors are the representatives of the five national otolaryngological associations: The American Otological Society, The American Laryngological Association, The American Laryngological, Rhinological and Otological Society, The American Academy of Ophthalmology and Otolaryngology and the Section of Laryngology, Otology and Rhinology of the American Medical Association.

The object of the Association is to elevate the standard of otolaryngology; to familiarize the public with its aims and ideals; to protect the public against irresponsible and unqualified practitioners; to receive applications for examination in otolaryngology; to conduct examinations of such applicants; to issue certificates of qualification in otolaryngology, and to perform such duties as will advance the cause of otolaryngology.

The first examination will be held at the time of the meeting of the American Medical Association.

The work of the Board, examination into the qualifications of those who desire to be recognized as specialists and the issuing of certificates, will, it is believed, have a wide-reaching effect. In the first place, it will have the effect of educating the medical public to a better apreciation of what should be undertaken in the way of preparation by those who take up this line of work. The certificate should aid the public in much needed discrimination between the man properly prepared to practice the specialty, and those who without sufficient preparation are willing to pose as specialists. Hospital managements should welcome the movement, as it will aid them in determining not only the selection of men to serve in the Department of Otolaryngology but in determining what men shall be allowed to bring patients into the hospital for nose and throat operations. Hospital managements, who desire to make their institutions places in which patients can be assured of receiving competent service in matters relating to otolaryngology, can do so by insisting that the men who are permitted to practice otolaryngology in the hospital hold the certificate from the American Board of Otolaryngology.

The American Federation of Organizations for the Hard of Hearing held a meeting of the board of managers in New York, Oct. 24, 1924. It was decided by the board to broaden still more the scope of work to be undertaken by the League. Nine special committees were appointed, dealing with such subjects as employment bureaus for the deaf, medical and scientific research into the problems of the deaf, educational problems of the deaf and so forth.

The educational committee aims to make a sectional survey of the hard of hearing in our public schools, to make a study and recommendations of the best methods for teaching these children and finally, to work on the standardization of lip reading for adults.

POSTGRADUATE COURSE IN OTOLARYNGOLOGY IN BORDEAUX

Prof. A. Georges Portmann has arranged to hold a postgraduate course in otolaryngology each summer during the months of July and August. The first of these courses was given last summer. The next course will commence on July 10, 1925, and terminate on August 20.

Abstracts from Current Literature

CONSIDERATION OF THE LARYNGEAL INNERVATION IN TWENTY-FIVE CASES OF LARYNGEAL PARALYSIS DUE TO WAR WOUNDS. F. J. CALLET, Arch. Internat. de laryngol. **3**:509, 1924.

Paralysis of the larynx from wounds received in war, is due in the great majority of cases to lesions of the pneumogastric nerve, and in rare cases, to a lesion of the recurrent laryngeal nerve. In injury of the pneumogastric alone, the left was affected more frequently than the right.

Cardiac changes may occur at once or after a protracted period. They may disappear to return again or may be permanent. The pulse was accelerated to 140 at times. Other patients presented symptoms of tachycardia with irritability of pulse, sometimes extrasystolic impulses and often suppression of the oculocardiac reflex. Laryngeal paralysis may be pure, or associated with glossolaryngeal, palatolaryngeal, pharyngolaryngeal or laryngoscapular paralysis.

The presence of these associated symptoms serves to locate precisely the position of the lesion.

In laryngeal paralysis accompanied by disturbance of sensation, it would indicate an injury of the superior laryngeal, while motor symptoms would be characterized by a paralysis from injury of the recurrent laryngeal.

It appeared in some cases that defect of tension was the dominant feature.

The only difference between a lesion of the pneumogastric below the superior laryngeal, and a lesion of the recurrent was the presence of cardiac symptoms.

The vocal cord is usually found in the cadaveric position with or without paralysis of the tensor. Median position cord paralysis is relatively more frequent than is paralysis by compression, and is more frequently indicative of a traumatic lesion which does not progress unless attended by compression.

Compensation takes place early in these cases by the healthy cord.

The phenomena usually disappear in the first two months, although sometimes only after a period of four or five months.

TROUBLES OF THE PHARYNGEAL WALL IN PARKINSON'S DISEASE. D. I. VASILIO, Arch. Internat. de laryngol. **3**:565, 1924.

The report of a child, aged 8 years, who had epidemic encephalitis for six months is given.

In the course of convalescence the speech was affected, characterized by spasm of the tongue which lasted from a moment to a few minutes.

In the beginning the speech was normal, when the tongue suddenly contracted in a spasmodic manner. The point was straight but the tongue was curved laterally. At the same moment the mouth was opened and saliva was emitted in abundance.

This spasm passes in a moment or two, articulate speech is regained when another crisis takes place.

Concurrently with the spasm of the tongue, the masseter muscles are affected with spasm, which prevents movement of the jaws.

The author suggests that the mutism of sleeping sickness may be caused by these continuous spasms of the tongue, as this important organ is the one which formulates articulate language.

A CASE OF CONGENITAL CUTANEO-MEMBRANOUS OCCLUSION OF THE ANTERIOR NASAL ORIFICES. MAYERSOHN, Arch. Internat. de laryngol. **3**:608, 1924.

The patient was a girl, aged 13, who had complete occlusion of both anterior nares. She complained of a continual discharge into the pharynx. Her general health was poor and her appearance delicate. She had no olfactory sense.

Under chloroform narcosis, the two diaphragms were destroyed by galvanocautery. One of the membranous partitions was about 1 cm. in thickness.

Several cicatricial bands in the interior of the nose were destroyed. The cavity was packed with gauze, which after twenty-four hours was replaced by rubber tube drains.

For two months the passages were treated with dilating sounds. The final result was good; the patient breathed normally through the nose and her olfactory sense became normal.

CANCER OF THE LARYNX TREATED BY RADIUM PUNCTURE. MAYERSOHN, Arch. Internat. de laryngol. **3**:610, 1924.

The patient, a man, aged 45, presented himself with a tumor on the right vocal cord. Histologic examination revealed a growth of stratified pavement epithelium with epithelial nests. Five applications of a radium needle in the center of the tumor was applied for three hours at each treatment.

This caused the tumor to disappear after two months. Four months later the appearance of the larynx was normal except that the left cord was slightly reddened.

The author remarks that, in his experience, this is the first laryngeal tumor which has apparently been cured by radium.

LOCAL VACCINE THERAPY IN OZENA. M. M. REBATTE and H. PROBY-LYONS, Arch. internat. de laryngol. **3**:1021, 1924.

The local application of vaccines, instead of submucous or subcutaneous injections, was shown to be desirable. The method of application of the vaccine was by scarifying the mucous membrane or the skin, after which the vaccine was applied to the raw surface. Results as compared with the submucous and subcutaneous methods were very encouraging. In three patients treated, there was considerable amelioration of symptoms. In three others the crusting disappeared and atrophy of the turbinals was less marked, while the color of the mucous membrane assumed a more normal character. The vaccine was applied in petrolatum emulsion. The advantages included lack of general vaccine reactions, such as are often exhibited by the injection method of administering the vaccines.

ROBERTSON, Chicago.

THE ADVANTAGES, INCONVENIENCES AND DANGERS OF LOCAL ANESTHESIA IN OTORHINOLARYNGOLOGY. BERGVAD, Rev. de laryngol. **5**:146, 1924.

The author divides local anesthesia into three types. 1. Superficial anesthesia, in which the anesthesia is brought in local contact with tissues by applications. 2. Infiltration anesthesia, in which the anesthesia is injected directly in the operative field. 3. Regional anesthesia, divided into two types, (*a*) peripheral regional anesthesia where the injection is placed in a nerve in its passage to the periphera, (*b*) central regional anesthesia where the injection occurs at the point of emergency of the nerve from the central organ. Local anesthesia is considered for the most part exempt from danger. In taking up the various drugs used, the author stresses certain rules which add to the safety of the procedure. 1. The strength of the solution should be as weak as possible. 2. In cases where cocain is used, the strength of the solution should never exceed 10 per cent. 3. It should never be applied more than four times in thirty minutes. 4. One side of the nose only should be operated on at a time. 5. The cocain solution should always be applied on a small cotton applicator. 6. A drop of epinephrin should be added on each application. 7. It should be used with the greatest care in infants, cardiac patients, tubercular patients, in the aged and in pregnant women.

In the treatment of intoxication from local anesthesia, the head is lowered, injections of camphorated oil, and where the heart is affected seriously, digitalis, nitrate of amyl and injection of calcium chlorids are given.

Alypin, in the author's opinion, is a poor substitute for cocain. Although less toxic it is less effective.

Procain-epinephrin is much less toxic (one-eighth) than cocain, although toxic symptoms have been observed from its use. Certain rules are given for its administration.

1. Weak solutions of 1 or 0.5 per cent. should be employed in a small syringe, to avoid the temptation of injecting too great a quantity. The maximum dose of 0.5 per cent. is 30 gm.
2. Never inject directly into a blood vessel.
3. Never sterilize the needle or syringe in chlorinated soda solution, as this will decompose the epinephrin of the solution.
4. The injections are made very carefully, desisting at the slightest sign of intoxication.

General narcosis is still advocated for unruly patients, operations on the ear, in long and delicate treatments and in operations on diabetic patients. Usually such patients are given 0.02 gm. of morphin without scopolamin one hour before operation.

AUTOVACCINATION IN OTORHINOLARYNGOLOGY. WORMS and G. DELATER, Rev. de laryngol. **8**:307, 1923.

Statistics of patients treated are given separately under diseased conditions.

Infection of Cutaneous Origin.—In four cases of furunculosis of the external auditory canal and two cases of furunculosis of the nasal vestibule, the pain rapidly subsided but it became necessary to continue the administration of autovaccines over a period of weeks to avoid recurrence of the disease.

Infection of Mucous Membrane Origin.—In acute sinusitis the treatment was of value as a prophylactic measure, although a few cases terminated satisfactorily with no additional treatment. In three cases of pansinusitis, pain disappeared quickly but the suppurative process did not respond to the treatment. The secretion was diminished in quantity, the fetor disappeared, while the nasal mucosa appeared more healthy in character.

In chronic sinusitis very little effect was noted except that pain was in a measure mitigated. In all cases, operative treatment had to be resorted to, while as an adjuvant treatment postoperative, the therapy seemed to have a decided beneficial effect.

The two cases of chronic crusting without atrophy were treated by two series of injections with beneficial result.

In chronic otitis two patients failed to show benefit.

In mastoiditis, autovaccine therapy was not used exclusively, the patients having all been operated on. The healing of postoperative wounds seemed shortened where the vaccine therapy was employed.

ROBERTSON, Chicago.

THE TREATMENT OF VERTIGO BY EPINEPHRIN. BARBAZAN, Rev. de laryngol., d'otol. et de rhinol. **7**:291, 1923.

Epinephrin with good results was administered in two patients to relieve vertigo. Case 1 presented a true Ménière syndrome, while Case 2 had slight deafness which the author termed a false Ménière syndrome. It is thus shown that epinephrin may be effective in these cases even when given by the mouth. It is necessary to administer the epinephrin in 20 or 30 drop doses given twice daily and in the absence of associated medication.

ROBERTSON, Chicago.

ERYSIPELAS OF THE RESPIRATORY TRACT AND EAR. F. REINKING, Ann. Soc. Mex. de Oftal y Oto-Rhino-Laryngol. **4**:21, 1924.

Two cases are reported, in which active redness attended with high temperature with no appearances of suppuration occurred. In both patients one side of the nose and the external ear of the same side were affected. Temperatures

were as high as from 39 to 40.5 C. (from 102 to 104 F.). In one of the patients the disease lasted for seventeen days before recovery. Diagnosis was confirmed by the absence of suppuration and high fever.

ROBERTSON, Chicago.

NEW INVESTIGATIONS ON CHOLESTEROL METABOLISM. J. BERBERICH, Klin. Wchnschr. **3**:2003 (Oct. 28) 1924.

The author determined the blood cholesterol in thirty patients with otosclerosis. With one exception, all had quite low figures: from one half to one tenth of the norm. Two patients were near the term of pregnancy. One had 0.2 per cent., the other, 0.21 per cent. of cholesterol in the serum. This would seem high; but, in view of the expected cholesterolemia of pregnancy, the figures are low. He points to the fact that otosclerosis is apt to progress in the second half of pregnancy, just when the blood cholesterol increases as a rule and the cholesterols disappear from the ovary. He finds it probable that compounds of cholesterol esters (the fatty acids) might be found in the affected ear, especially in the form of soaps of calcium. Fleischmann found similar low cholesterol figures in the blood in ozena. The author demonstrated crystals of cholesterol in the nasal secretion of these patients. While the blood cholesterol is increased in diseases of various etiology which are acquired and usually transient, the hypocholesterolemia occurs in patients who are constitutionally injured and suffer from degenerative processes which have no healing tendency. The familial and hereditary influences might point to a weakness of the endocrine system.

SCHULHOF, Chicago.

LOCAL EPINEPHRIN TREATMENT OF GRIPPAL CROUP. W. ARNOLD, Monatschr. f. Kinderh. **28**:515 (Sept.) 1924.

The symptoms of laryngeal stenosis in influenza are due to hyperemia of the small blood vessels and edema. There is, however, almost complete absence of pseudomembranous formations. Therefore the author in such cases swabbed the larynx (touching the vocal cords) with from 0.5 to 1 c.c. of a 0.1 per cent. solution of epinephrin. He had good symptomatic results in all his four cases of influenza croup. The treatment failed in two cases of diphtheria.

SCHULHOF, Chicago.

PROBLEM OF LOCALIZATION OF SOUNDS. S. GATSCHER, Wien. klin. Wchnschr. **37**:731 (July 24) 1924.

Gatscher reports on the experiments he made with Kreidl to disprove the "time theory" of localization of sounds. They determined the dichotic time threshold (the smallest time interval between two sounds reaching each ear separately and sufficient for separate perception of them). The figures obtained were, for murmurs, 0.03 second; for the tone b^1, 0.0175 second. The time theory which explains the localization of sounds by the time difference in which they reach both ears would require in the optimal case an ability to distinguish differences of 0.006 second and the possibility of perception of differences of 0.00003 second. In small animals with the smaller distance between the ears, these figures would have to be still smaller. Therefore they support the intensity theory, which explains the localization of sounds by differences in their intensity in each ear. If one ear is closed, a sound coming from backward is localized toward the side of the open ear, because this receives the stronger stimulus. Kreidl closed one ear of a subject and tested the localization of tones of an Edelmann whistle situated near the ear. The high tones (a^4) were localized toward the opposite side, while the low tones (e^2) were localized correctly on the side of the closed ear. Kreidl's supposition that high tones do not pass the obstacle was confirmed on a model.

PHYSIOLOGY AND PATHOLOGY OF DEGLUTITION. J. FLESCH, Wien. klin. Wchnschr. **37**:779 (Aug. 7) 1924.

After a survey of the physiology of deglutition, the author deals with some of its pathology. The first (oral) phase is distributed in affections of the tongue and palate. A tube bent at a right angle and reaching the base of the tongue overcomes the pains in feeding. In painful processes localized in or around the tonsils, we have to resort either to nasal feeding or use a method which has proved valuable in most cases: The empty swallowing or swallowing of saliva is most painful, because the muscles of the tongue, palate and pharynx have to contract maximally until occlusion is obtained. The more fluid is passing between the arcs, the less and more slowly do they contract. Besides this, occlusion against the isthmus faucium is obtained in this case already in the oral cavity (lips, cheeks and the fluid contents). The author recommends the following method in phlegmonous peritonsillitis and similar conditions: The patient sits up and fills his mouth with milk to capacity (cheeks bulging). After this he bends the head slowly backward. The base of the tongue falls on the epiglottis during this phase. Then the whole mouthful is swallowed with one movement. It is easy and almost painless to bring down over 4 ounces of fluid. The technic of nasal feeding, which may be used in laryngeal conditions, is as follows: The patient lies horizontally, with only a small pillow under the head. The feeding has to be rhythmical; the single amount poured into the nose must not exceed 5 c.c. The fluid has to flow on the floor of the nasal cavity. The food should be lukewarm and of a fine consistency, if only half fluid. It is good to finish the feeding by a few spoonfuls of a 1 per cent. solution of sodium bicarbonate to cleanse the nose. As soon as the food reaches the pharynx, the deglutition reflex is produced. Patients with bulbar affections and postdiphtheria paralysis should be fed with small amounts of more solid food in the upright position.

SENSATION OF ROCKING GROUND IN NEURASTHENICS. S. GATSCHER, Wien. klin. Wchnschr. **37**:868 (Sept. 4) 1924.

Gatscher points out that the otholitic apparatus receives in walking, stimuli from the upward and downward movement of the head. These stimuli do not reach the consciousness, because the centers get accustomed to them. It is possible that the otholitic apparatus may be more irritable in neurasthenic patients, just as it had been demonstrated on the reflex irritability of the vestibular nerve (caloric and rotatory stimuli). Under such circumstances the stimuli may become perceptible. The upward and downward movement of the head is mechanically the same whether the body moves or whether the ground is unstable. Therefore the stimulus is capable of producing perception of disturbed equilibrium, analogous to a passive movement. The difference between dizziness and this sensation of rocking ground is evident. The dizziness is a strict illusion, while this sensation is only a wrong projection of a real phenomenon.

SCHULHOF, Chicago.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Nov. 10, 1924

E. P. Norcross, M.D., *Pesident*

Dr. G. W. Boot demonstrated a special instrument composed of a wire threaded at the end like a screw, for removing a glass bead from the bronchus.

The Chairman congratulated the members of the Society on having as their guests the members of the American Board of Otolaryngology, which held its first meeting here during the day and effected a permanent organization. The Chairman then introduced Dr. Shambaugh who was responsible for the founding of the Board, who spoke on the objects and plans of the American Board of Otolaryngology.

Dr. Shambaugh pointed out that medical science had progressed to such an extent that no one hoped to become really expert in more than a limited field, and this had resulted in the development of medical specialties to an extent that could not have been surmised a few years ago. The tendency toward specialization had outstripped all plans for providing proper training for such work, universities having been absorbed in the problems of undergraduate medical training. Physicians desiring to take up some special field have been left largely to their own devices for getting preparation. Some succeed fairly well in their efforts. The majority of men in recent years restricting their practice to otolaryngology relied solely on a smattering of knowledge regarding a few operations, all of which they acquired in a few weeks' attendance at special clinics. These men lack entirely the training to make proper technical examinations and have acquired no appreciation of the indications for operative work, both of which are much more important than operative technic in the preparation of the specialist. Such men cannot avoid doing a lot of unnecessary operating, which has brought untold harm to the specialty. This situation has been widely appreciated and the subject of devising some correction has been often discussed.

It would be quite logical to seek legislative measures to protect the public against the impostors posing as specialists without any proper preparation. However, to secure correction by legislation seems impractical. Two years ago the chairman of the Section on Otolaryngology of the American Medical Association asked for a committee to report on the question of devising some national examining board, to pass on the qualifications of men who desire to be recognized as otolaryngologists, and Dr. Shambaugh was made chairman of a committee to look into the question. He secured the cooperation of the several national organizations devoted to otolaryngology, and with a committee consisting of a representative from the American Laryngological Association, the American Otological Society, the American Laryngological, Rhinological and Otological Society and the American Academy of Ophthalmology and Otolaryngology, worked out a plan whereby each of these organizations, together with the Section on Otolaryngology of the American Medical Association, should appoint two members to act as the American Board of Otolaryngology. This report was favorably acted on by each one of the special organizations and the committee as recommended was formed.

The committee met to plan an organization. All of the members feel that the movement means very much for the elevation of the practice of otolaryngology. Dr. Shambaugh pointed out some of the advantages to those holding certificates from the American Board. First, anyone desirous of becoming a member of any of the four national organizations represented on the committee must possess the certificate before his name can come up for

consideration. Second, any physician possessing the certificate of the American Board of Otolaryngology and who passes the Credentials Committee of the American College of Surgeons will be admitted to this organization without further examination. Third, the certificate will be in a form suitable for display in the doctor's office and will serve as an introduction to the physicians as well as to the laity of the community in which he desires to locate. The possession of such a certificate will at once distinguish the properly prepared physician from the pseudospecialist. Fourth, hospital managements in selecting men to do the work in otolaryngology will be glad to avail themselves of the information provided through the American Board of Otolaryngology in determining what men should be permitted to practice otolaryngology in the hospitals. The spectacle which one can witness any morning at many of our general hospitals where a line of general practitioners, pediatricians and general surgeons is posted, each with his string of patients for nose and throat operations, reflects very little credit on the hospital management which is permitting such a thing, and less credit on the men who are indulging in this orgy of nose and throat operating. It is for the purpose of elevating the standards of practice in otolaryngology, for instructing the medical public in what constitutes proper preparation for those entering on special practice and for protecting the general public against unqualified men attempting to practice in this field that this Board has been established.

The Chairman asked for remarks from tne several members of the Board.

Dr. H. P. Mosher, Boston, said that because Dr. Shambaugh, the father of the committee, had disowned his child by not permitting himself to be placed on the Board, he found himself occupying the position of chairman. Personally, he was glad of the opportunity of helping to distinguish the properly trained man. The protection of the public is all right, but he thought that the men who have spent long efforts in preparing themselves for the practice of the specialties should be protected from the unprepared man taking this work from them. He was sure that the gentlemen of the Board were all taking the matter very seriously and they confidently hoped for cooperation from the specialists in otolaryngology.

Dr. H. W. Loeb, St. Louis, spoke of the rapid progress which otolaryngology had made from the period when this was referred to as the spraying profession until it now has taken its proper place in surgery with its spectacular results. The specialty still lacks the balance that it should have. Today there are 5,000 men listed in the directory of the American Medical Association professing to be otolaryngologists. When the Board has begun its work, many of them will learn that they are not qualified. The Board takes the matter very seriously, and is going into the work with the feeling that the association has selected them to bear the burden of determining who is qualified and who is not. This is the job which they have undertaken. They hope that every member of the Chicago Laryngological and Otological Society will possess their certificate, and that every real otolaryngologist in America will apply for the certificate from the American Board. In time, the Board will be able to supply a directory including a list of men who are properly qualified to practice otolaryngology. This will be a great assistance, not only to otolaryngologists in various parts of the country in determining to whom they can safely refer patients, but to the medical profession at large as well as to the lay public.

Dr. B. R. Shurly, Detroit: The founding of the American Board of Otolaryngology was the natural development from the steady progress that has been going on in this specialty. He hoped that everyone in this Society would get the spirit of the American Board in its endeavor to raise standards. Everyone who is properly qualified in this specialty should be recognized. Many suggestions have been obtained from the Ophthalmic Board which has been functioning for several years.

Dr. W. H. Wherry, Omaha, reiterated the sentiments that had already been expressed, regarding the sincerity of purpose of the members of the Board. He had never been connected with any undertaking where there appeared such an appreciation of responsibility that prevailed among the members of the Board. It should not be inferred from the remarks of Dr. Shambaugh and Dr. Mosher that the effort would be to make it hard for men to pass the Board. That is not the object. On the other hand, it is not the intention to issue certificates except where men are properly qualified, for a certificate issued too freely would defeat the whole purpose of the Board. In visualizing the future he believed that the work of the Board will in time dispel among the general medical public any feeling of disparity toward those practicing otolaryngology. The men selected for the Board are in themselves an assurance that the work will be honestly and reasonably carried out.

Dr. F. R. Spencer, Boulder, Colorado, stated that perhaps one of the things the Board could do in the future would be to disseminate information obtained from the various medical schools, setting forth what facilities exist for graduate work in otolaryngology. The Board is not aiming to grant a degree. The certificate is simply one of proficiency in otolaryngology.

Dr. T. H. Halsted, Syracuse, New York, stated that the objects of the Board had been pretty thoroughly discussed, that the Board in Ophthalmology had accomplished a great deal and he felt that the new Board would be able to do a similar work for our specialty.

Dr. J. C. Beck, Chicago, mentioned that Dr. Skillern, Dr. Carmody, Dr. Mosher and himself had been serving on a Board from the Academy looking into the qualifications of those who desired membership, and that quite a number of the members of the Chicago Society had passed this Board. The American Board will conduct similar examinations but will be more rigid in their requirements than the Board from the Academy.

Some Observations on Certain Forms of Chronic Sinuitis. Presented by Dr. Ross Hall Skillern, Philadelphia.

Length of time cannot be used to separate acute from chronic conditions. Chronicity depends first on interference with aeration and drainage. This may be natural, anatomic or acquired. Under the acquired he would include recurring acute coryza, resulting in thickening of membranes and inhibition to the movement of the cilia. The type of infecting organism is also important. His discussions were restricted to the true sinuses, frontal, maxillary and sphenoid, having unyielding, bony walls.

Chronic frontal infection is usually the result of recurring head colds, sometimes traced to an earlier attack of influenza. If the causative factors in chronicity are removed, the condition ultimately may return to normal. Very simple intranasal work is required. With the fistula formation the situation is different. Here an extensive external operation is usually necessary. Chronic maxillary sinuitis presents a wide range of symptoms. In the mildest forms, the antral mucosa undergoes polypoid changes with no particular symptoms, until sooner or later an infection starts a chronic suppurative process which necessitates the use of chisel and curet. He thinks the danger from needle puncture has been exaggerated. He always makes the puncture through the inferior meatus, first injecting a small quantity of air under slight pressure. Where resistance is felt the needle is removed to see if the opening has been closed. Chronic sinuitis, the result of a decayed tooth, is rare as compared with the cases of nasal origin. Twenty per cent. is too high. Occasionally in chronic antrum disease the sinus is filled with a solid mass resembling cream cheese and still less frequently the sinus becomes the seat of mucocele.

In the sphenoid sinus alterations may be all the way from a low grade, nonsecreting, symptomless catarrh to that of a profuse, purulent discharge with pain and aches in the near and remote portions of the body. One symptom is dull pain in the supraorbital region of the affected side.

A Radical Operation for the Relief of Chronic Frontal Sinusitis When a Part of a Pansinusitis. Presented by Dr. R. C. Lynch, New Orleans.

This was a lantern and moving picture demonstration. Indications for the procedure may be summed up by stating that after all else had failed, this was the operation of choice. The procedure was not new, except for certain details which have been elaborated as the result of failures in earlier cases. The operation consists of a modification of the Arnold-Knapp and Jansen's procedures. He considers a cure only when by inspection with the nasal speculum the nose is found free from pus. Practically all are free from supraorbital pain. Of course, the extensive procedure is totally unwarranted in acute conditions.

The patient is prepared by cleansing of the nose and lavage, a post nasal tampon is inserted and the nasal passages packed with gauze soaked in alcohol. These remain in the opposite side throughout the operation. Just before making the primary incision, the gauze on the operated side is replaced by gauze soaked in epinephrin. The eyebrow is not shaved.

The incision is the same as for the Killian operation except it extends through the periosteum. Where the size of the sinus permits, it is not carried beyond the supraorbital notch. It is carried down along the lateral wall of the nose to about the end of the nasal bone. The periosteum from the floor of the orbit and nasal wall is removed including the pulley for the superior oblique and the lacrymal sac. The periosteum of the upper part is not touched. The floor of the orbit as far as required is removed together with the orbital wall of the ethmoid. It is very important to make the opening into the frontal sinus large enough to permit of the complete exenteration of the pathologic membranes in this cavity. Cross cuts are made in the first incision before lifting the periosteum to assist in approximating the skin afterward. He had been told that he could expect recurrences as late as ten years afterward.

No attempt is made to suture the periosteum. He does not introduce the rubber tube into the nasofrontal opening. The after-treatment is to leave the conditions severely alone. The patient is instructed not to blow his nose.

DISCUSSION

Dr. Norval H. Pierce (Chicago), stated that this operation differs little from the old operation except the frontal plate is not disturbed. If it is possible to operate successfully without disturbing the frontal plate there is a distinct advantage. There are cases where it would be essential to take away the external plate; for example, where there is a fistula going through the inner plate of the skull. Here the question of deformity cannot be considered. Theoretically, he does not see why good results could not be expected from this operation except in cases where the upper boundary of the sinus is very high. In a large frontal sinus it will be necessary to take away the whole of the orbital plate. To one who has operated in the depths of these bleeding sinuses, the photographs and the movie indicating an easy operation were somewhat misleading.

Dr. H. P. Mosher stated that the more he had to do with frontal sinus operations the more he feels that failures are due to insufficient removal of the floor. Dr. Lynch, in operating through the roof of the orbit, is striking at an important point in frontal sinus operation. He has had recurrences due to failure to remove the outer angle; also the failure to recognize a cell not mentioned by Dr. Lynch, the frontal ethmoidal cell. Dr. Lynch disregards the pulley and by taking it down secures a better view. He operates farther back in the ethmoidal labyrinth than does Dr. Mosher. He criticized the method demonstrated in the movie of inserting the postnasal tampon. He had never had trouble with sequestration of the frontal plate, mentioned by Dr. Lynch as a reason for not lifting the periosteum. He does not believe that it is possible to remove thoroughly all the mucous membrane of the sinus by working from below. It is not easy to find the nasofrontal duct working

from below. As for removing every vestige of mucous membrane from the frontal, ethmoid and sphenoid, he does not believe it possible.

Dr. Pierce mentioned that he had operated not long ago on a patient, on whom Killian had operated eighteen years before, a purulent recurrence. The nasofrontal duct could not be found. He does not regard recurrences as serious and wonders why we do not have them more frequently. Should recurrences occur within two, ten or eighteen years it is not a failure of the operation.

Dr. Charles Robertson (Chicago), called attention to the relation of the carotid artery to the outer wall of the sphenoid, and the fact that dehiscences occur makes it necessary when curetting this sinus to enter at a twenty degree angle from the side. This can be done by first opening the antrum and entering by that route, going through the posterior ethmoid cells. In the demonstration, the curet was parallel to the septum which he considers dangerous. The operation on the frontal sinus should be guided by the skiagraph. In a recent case there were two frontal sinuses, one small, out along the brow. He does not think it possible to curet the sphenoid sinus so as to remove all the mucous membrane. He has seen cases where the pituitary cyst projects into the cavity, and he considers the dehiscence of the upper wall the result of necrosis from a sphenoid disease.

Dr. Alfred Lewy (Chicago), inquired whether Dr. Lynch considered a removal of the posterior ethmoid and the operation on the sphenoid necessary in all cases; also the possibility of local anesthesia.

Dr. J. C. Beck (Chicago), referred to a patient on whom he had performed three external operations within three years, a very extensive sinus. Each time he thought he had removed all the mucous membrane and in each instance he had a recurrence. Dr. Lynch's operation may be applicable to the ordinary case but exceptional cases require removal of the frontal plate. He inquired of Dr. Lynch whether the lifting out of the tear sac which is so easy was not followed with epiphora for some time, not to speak of diplopia.

In discussing Dr. Skillern's paper he stated that he was always irritated when he learned of men squirting air after puncturing the sinus. Why inflate where you can accomplish the same result by suction? The danger has not been overestimated. Authentic cases have been reported of sudden death.

Dr. Edwin McGinnis (Chicago), inquired whether indications other than that of pain exist for the radical operation. Judging from the moving pictures, no effort had been made to secure intranasal drainage.

Dr. Harry Pollock (Chicago), emphasized the danger of curetting the sphenoid sinus. He had seen cases of dehiscence of the posterior wall with the carotid exposed. He took one exception to Dr. Skillern's discussion and that was the time element in determining chronicity. He had had two or three patients where symptoms had existed for four years, and a single irrigation sufficed to cure the trouble entirely.

Dr. Geo. J. Musgrave (Chicago), suggested that after dissecting the periosteum one should enter the ethmoid labyrinth and dissect the way upward.

Dr. Henry Boettcher (Chicago), after watching Dr. Lynch do this operation said he had operated on two patients, one of whom developed a frontal fistula.

Dr. R. H. Goon (Chicago), pointed out the disadvantages, first, in disturbing the pulley of the oblique; second, in removing the entire floor the eye sinks backward and upward; third, failure to get a view of the posterior wall; fourth, removal of the lacrymal bone. He referred to one of Dr. Lynch's cases where the patient suffered from diplopia. Infection of the opposite frontal developed, which was relieved by intranasal operation.

Dr. Skillern (closing), stated that although Dr. Beck took exception to the inflation of air in the needle puncture he would still continue to do so, using slight pressure. The occasional cure of a rather long standing condition by a single or a few injections rather emphasizes the exception to the rule that such cases require something more than irrigation. He did not wish to leave the impression that he was giving up doing the radical external operation, but he had a clearer conception of the proper indications for the radical operation than he may have had formerly. Absolute indications are threatened or real cerebral complications, orbital complication, continuation of foul secretions with severe persistent headaches. The first two have to be handled immediately by external methods; in the latter, one is still justified in attempting to relieve by intranasal surgery. In working on the frontal sinus, one should not ask the patient to submit to having something done which the surgeon would not care to have done for himself.

Dr. Lynch (closing), said that no operation could be considered suitable for every situation that might present itself. So far, the operation which he described has met successfully all situations which he encountered. The operation itself is not easy, and it approaches major surgery as nearly as anything which the rhinologist is called on to do. Where recurrences occur, they are likely due to faulty technic and we should be our own severest critics. In the paper itself, which he did not read, he emphasized the treatment of the antrum and the removal of the anterior ethmoid cells and tackling the sphenoid sinus through the antrum. The more he sees of frontal sinus operations, the more he has come to recognize the impossibility of getting through the frontal ethmoid cells by intranasal method and this is one of his reasons for taking up the external method.

As to curetting the sphenoid, in the last four or five patients he has been able to secure a satisfactory view directly into the sinus. It is impossible mechanically to curet every sphenoid sinus even with a wide opening. Whatever curetting is done should be done under direct inspection and very gingerly. In reply to Dr. Lewy, he stated that in attempting to outline indications for this operation he stressed the fact that everyhing else had been attempted already. In all cases of true pansinusitis the posterior ethmoids are involved and have to be removed with the anterior cells. He has had no case of epiphora or disturbance of the lacrymal apparatus. Diplopia has occurred six or seven times but gradually cleared up. Where the antrum is involved, he does a maxillary sinus operation first at which time he includes exenteration of the lower group of ethmoid cells opening up through the antrum going back as far as the anterior face of the sphenoid and into the sphenoid. If this operation does not clear up the frontal sinusitis, then the radical frontal is advised. It is quite impossible to do anything like the extensive cleaning out of the frontal sinus by the intranasal route. As to curetting the sphenoid, he has been doing that only in the last five patients where he proceeded with great caution.

Mention was made of one of their patients in which they had a calamity. In one there was death from meningitis, following an osteomyelitis. The case of diplopia mentioned by Dr. Good was one where there was a colon infection, which necessitated the opening of the incision and draining the external wound for a long time. He had in addition to the pulley disturbance, paralysis of the third nerve. In at least eighty-five of the 100 cases they have had so far, no disturbances of the superior oblique has been noticed. Of course if you buttonhole it and loosen up the attachment that will interfere with its function.

As regards inspection of the posterior wall this, so far as the line of vision goes, is thoroughly opened up, except perhaps in a situation at the upper angle referred to by Dr. Pierce. This situation, of course, requires a special operation. Otherwise the posterior wall comes into view as satisfactorily as through the anterior wall.

A. A. Hayden, M.D., Secretary.

SECTION ON OTOLOGY AND LARYNGOLOGY OF THE COLLEGE OF PHYSICIANS, PHILADELPHIA

Monthly Meeting, Wednesday, Oct. 15, 1924

GEORGE FETTEROLF, M.D., *President*

MASTOIDECTOMY ON A CASE OF MASTOIDITIS STREPTOCOCCUS HEMOLYTICUS FOLLOWED BY SEPTIC PHLEBITIS. RECOVERY WITHOUT OPERATION ON THE SINUS. Presented by DR. E. B. GLEASON and DR. PHILIP S. STOUT (by invitation).

Dr. Gleason presented a child, aged 6 years, on whom Dr. Stout had done a radical mastoid operation in May, 1924. The history of the condition previous to operation was not unusual and showed no departure from the usual clinical course of such conditions. At operation, the left mastoid was found to be filled with pus and the bone showed osteomyelitic changes. Thorough drainage was accomplished without exposure of either the lateral sinus or middle fossa.

Several days following operation, the child's temperature began to show wide excursion, reaching at times 105 F. and being septic in type. A blood culture at this time was positive for *Streptococcus hemolyticus*, which was the organism present in the mastoid pus. The mentality was well preserved. Leukocytes, which at first were 11,800, rose in a week to 22,300. Dr. Gleason considered the case one of infective thrombosis of the jugular bulb. Several other observers disagreed with this diagnosis. It was decided not to operate. A stormy convalescence complicated by acute endocarditis, a metastatic abscess of the right hip requiring drainage, and the contraction of measles ended in recovery and discharge of the patient on Aug. 8, 1924.

It was the feeling of Dr. Gleason that few mastoid patients require early operation, that is, before a week or ten days. This allows time for a walling off of the process and insures a much shorter convalescence. In early operation a tedious recovery is more frequent, and many more cases so treated require secondary operative procedures. The most interesting feature of this case, as presented by Dr. Gleason, was that spontaneous recovery occurred without operation where the symptoms gave a rather definite clinical picture of sinus thrombosis.

DISCUSSION

DR. P. S. STOUT felt that in this case prompt operative measures were largely responsible for recovery.

DR. STAUFFER questioned the surety of the diagnosis of jugular sinus thrombosis. He cited a similar case, where a secondary collection had appeared in the opposite mastoid.

DR. WOOD considered the steeple type of temperature and other symptoms of this case sufficient to warrant the diagnosis of sinus thrombosis, but felt that with children great care must be used in making such a diagnosis, especially as they are so susceptible to wide temperature variations from many causes. He invited discussion of the diagnosis of sinus thrombosis.

DR. EVES considered the diagnosis of this case definitely to be sinus thrombosis, when the positive blood culture, previous history, temperature curve and other symptoms were considered. The case, in his mind, was one for operation. He cited several similar cases. One patient operated on recovered, following the removal of a sinus clot. Another on whom operation was delayed, died. Only if a patient has marked resistance can one afford to delay operation in mastoid cases.

DR. CARISS raised the question as to the time of development of the acute endocardial condition.

DR. COATES did not feel that the type of organism played much part in the tendency to the development of sinus thrombosis. He cited several series of

cases, which tended to show that sinus thrombosis was more likely in pneumococcic mastoiditis than when the hemolytic streptococcus was the exciting organism.

Dr. Babbit cited several cases of sinus thrombosis; in one, a hemolytic streptococcus infection, blood transfusion was of great value; in another 1 per cent. mercurochrome-220 soluble intravenously produced a prompt return of normal temperature.

Dr. S. MacCuen Smith considered the symptoms of this case indicative of a definite diagnosis of sinus thrombosis. In his opinion, in this condition the temperature may be constantly elevated or show the steeple phenomenon. A differential count is of some value. A retained clearness of mentality is usually present in this condition and should be considered. If possible, it is advisable to await a walling off of the infective process. The blood culture is not always positive. He cited several cases of supposed thrombosis that where mercurochrome-220 soluble was used, the patients recovered. When operation is done he feels that many patients will recover without ligation of the jugular vein. In fact, the additional shock of this ligation often offsets any advantage it may give. If at operation in the average case, free bleeding can be obtained from both ends of the sinus after removal of the clot, it is best not to ligate. As a general rule he feels it is probably the safest procedure to ligate. Many patients recover with no venous ligation.

Dr. Lewis called attention to a patient with double acute mastoiditis, on whom bilateral mastoidectomy was performed. A subsequent lateral sinus thrombosis developed. Some difficulty was experienced in determining which side was affected. Eventually this was done and operation performed with uncomplicated recovery.

Dr. Randall called attention to a differentiation between sinus phlebitis and thrombosis. To differentiate definitely is practically impossible, as the former precedes the latter condition. If the process goes no further than phlebitis, the patient has the better chance if not operated on. In acute cases, especially in children, nature's tendency is to close the sinus without the formation of a septic thrombus. It is in the longstanding, chronic cases where clotting is likely to occur. In cases such as these, operation gives the best results. In very acute cases, however, it is best to delay operation. A positive blood culture is greater evidence of phlebitis than of thrombosis. One should not forget that metastatic abscesses elsewhere can well account for symptoms of sinus thrombosis.

Dr. Walter Roberts stated that when sinus pus is definitely walled off, ligation should not be done.

Dr. George Fetterolf cited a case, in which the patient showed remarkable resistance to hemolytic streptococcic infection. The mastoid, lateral sinus, jugular vein, sternoclavicular joint, knee joint, appendix and pleural cavity were successively involved and all surgically treated. All lesions showed the hemolytic streptococcus. Recovery of the patient followed. One must, therefore, not fail to consider individual resistance in all cases of infection.

Dr. E. B. Gleason stated that his diagnosis of the infective process being lodged in the jugular bulb, rather than in the lateral sinus, was based on observation that during operation the lateral sinus had not been exposed and that in the wound healthy granulations were present over this area. Then, too, due to anatomic conditions in the child, the jugular bulb is more readily infected than in the adult. In operation for sinus thrombosis Dr. Gleason has never tied off a jugular vein. Sometimes at operation he has found no clot which he felt substantiated the statements of Dr. Randall concerning phlebitis. If a week or more has elapsed in these intracranial cases, it is the feeling of Dr. Gleason that the patients will spontaneously recover.

Dr. Stout stated that the presence of an endocardial infection was present postoperatively only. It is his feeling that the streptococcus and pneumococcus frequently occur together, one in the pus, the other in the spinal fluid.

REPORT OF A CASE OF SARCOMA OF THE NASOPHARYNX. Presented by DR. WALTER ROBERTS and DR. GEORGE SCHWARTZ (by invitation).

Drs. Roberts and Schwartz reported the case of a woman, aged 50 years, who came to them complaining of stuffiness of the right ear accompanied occasionally by paroxysmal pain. At first these symptoms were relieved by inflation. Later this maneuver gave no relief. Digital examination of the nasopharynx revealed a dense mass as large as a walnut, attached to the left wall. Palpable cervical glands on the right side were discovered. Laboratory and other examinations revealed no evidence of constitutional disease, such as syphilis or tuberculosis. A radiologist who was consulted advised operation, as he was unable to reach the mass for radium applications. The growth was removed by section of the superior maxilla and soft palate. The pathologic report was round cell sarcoma. To date, there has been no evidence of recurrence. The residual slit in the soft palate makes the locus of the original growth quite accessible for any sort of treatment. With the plate of her false teeth and a nasal obturator, the patient is quite comfortable.

DISCUSSION

DR. LEWIS stated that one of the most difficult problems of the rhinologist is the nasopharyngeal neoplasm. Pain in the ear is a frequent initial symptom. Before suspecting any growth, the tumor may attain quite large dimensions. He cited the case of a boy, aged 16, from whom he removed a round cell sarcoma of the nasopharynx by means of the snare and forceps. After six weeks there has been no sign of recurrence. At the Philadelphia Hospital he stated that radium application to the site of growth had given the best results.

DR. PFAHLER remarked that he considered it best to radiate and roentgen ray all these cases before operation. In the clinic of Frankfort, Germany, all such patients are treated solely by radiation. Dr. Randall considered operation in this case the proper procedure, due to the fibrous nature of the growth. Radium too, should be applied.

DR. S. MACCUEN SMITH cited a patient treated by Dr. Pfahler with roentgen ray and radium, who developed marked metastasis and died. He raised the question of the possibilities of surgery in this case.

DR. PFAHLER replied that this case of sarcoma was so far advanced that marked constitutional derangement had already occurred, and that therapy of any sort would have been of no avail. A contrast of surgical and radium therapy statistics would, he felt, speak favorably for radium.

DR. RANDALL called attention to a case of sarcoma in which the patient had completely recovered under treatment with Coley's fluid.

VINCENT'S ANGINA: A REVIEW OF SOME RECENT LITERATURE AND A REPORT OF TWO CASES. Presented by DR. THOMAS G. AIKEN.

DR. AIKEN pointed out that dental caries probably predisposes to and augments Vincent's angina. He called attention to the fact that death may result from this condition. He reported the successful treatment of two cases after the manner of Barenberg and Bloomberg.[1] In brief, this treatment consists of local applications of hydrogen peroxid to the infected areas, followed by a strong aqueous solution of sulpharsphenamin. Injections of the latter drug were also made into the gluteal muscle. He called attention to a patient, reported by Dr. David Husick, who died even though the before mentioned treatment was followed.

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1. Barenberg, L. H., and Bloomberg, M. W.: Use of Sulpharsphenamin in Vincent's Angina and Stomatitis in Children, J. A. M. A. **83**:25 (July 5) 1924.

DISCUSSION

Dr. Ersner stated that he had seen patients die after the condition had apparently cleared up. One died from pernicious anemia, another from lymphatic leukemia. He felt that the condition itself was an expression of lowered resistance. The Vincent's organism being anaerobic, hydrogen peroxid is of value as a therapeutic oxidizing agent. During the course of the infection the mouth is acid, as the condition clears up a gradual return to alkalinity is noted.

Dr. Wood stated that as long as the disease is limited to the tonsil, pure phenol (carbolic acid) readily effects a cure.

Dr. George Fetterolf confirmed the observations of others that fruit juices in large amounts seem to be of therapeutic value.

Dr. Aiken stated that patients showing this condition do appear to have lowered resistance.

Report of a Case of Carcinoma of the Tonsil. Presented by Dr. N. P. Stauffer.

A case of carcinoma of the right tonsil, in a woman, aged 60, with no recurrence a year after treatment, was demonstrated and reported by Dr. Stauffer. The laboratory diagnosis of the lesion was carcinoma. The treatment was carried out by Dr. Pfahler, and consisted of radium applications to the primary focus and roentgen-ray therapy of the cervical glands, which had been markedly involved. Complete healing of the primary focus took place as well as diminution in size of the enlarged cervical glands. Constitutionally, the patient also improved, gaining both in weight and strength. Mention was made of another case, in a man, aged 64, with a malignant growth at the base of the epiglottis. Although this patient has had several radium and roentgen-ray treatments by Dr. Pfahler and Dr. Newcomet, the growth seems to be advancing.

DISCUSSION

Dr. Pfahler stated that the first patient mentioned was treated to the limit of tolerance for two months with radium element. The neck was treated to the limit of tolerance with roentgen ray.

Dr. Lewis asked if tonsil malignancy was not particularly favorable to radium treatment. He cited nine cases of such malignancy, treated as before mentioned, with no recurrence to date.

Dr. Pfahler replied that different carcinomas respond differently to radiation, each being a law unto itself. As a general rule, malignancy of the tonsil and thyroid react more favorably to radiation than those elsewhere located.

Dr. Lewis asked Dr. Pfahler if he had seen any permanent cures effected by radiation in laryngeal carcinoma.

Dr. Pfahler replied that in this location adequate radiation was difficult, due to the tendency to laryngeal edema. He had seen no cures lasting over three years. In such cases he thought operation advisable.

Monthly Meeting, Wednesday, Nov. 19, 1924

The Diagnosis of Laryngeal Disease. Presented by Dr. Chevalier Jackson.

Dr. Jackson first presented the laryngostat, an instrument which allows a direct view of the larynx without penetration between the vocal chords. Later several specimens removed from various animals were demonstrated, among which were hair balls from the stomach of a ruminant, and a pin in the gizzard of a chicken demonstrating slow perforation by ulceration.

He next called attention to the complexity of laryngeal disease, and the care essential in arriving at a correct diagnosis. Mere inspection does not

suffice. Only by the most close and careful cooperation of the internist, pathologist, roentgenologist, serologist and bronchoscopist can the necessary studies be made and the proper conclusions drawn.

DISCUSSION

Dr. E. J. G. Beardsley commented on the thoroughness with which the work of Dr. Jackson is conducted. Many cases apparently most puzzling, after definite and thorough routine study, have proved to be quite simple. In laryngeal disease, all the circumstances which may have any bearing on its etiology should always be given careful consideration.

Dr. B. L. Crawford stated that the technic employed in the microscopic study of laryngeal tissue consists of paraffin embedding by a twelve hour method, followed by the cutting of serial sections. Frozen sections are not of value, on account of the small amount of material available. Occasionally it is necessary to perform a second biopsy if sufficient tissue was not obtained the first time.

Pulmonary Abscesses Following Tonsillectomy. Presented by Dr. R. M. Lukens.

Dr. Lukens stated that, at the Jefferson Hospital post tonsillectomic abscess constituted 36 per cent. of the cases of lung suppuration, which were treated bronchoscopically, exclusive of those caused by foreign bodies and certain forms of asthma. He stated that the incidence of lung abscess, of one out of every 2,500 to 3,000 tonsillectomies as stated by Moore, was probably too low.

In the series of eighteen cases presented, the average period between tonsillectomy and the initial symptoms was from seven to nine days. They may appear as early as one day or as late as a month following operation. Any postoperative symptoms, such as fever and cough, with or without expectoration, should be eyed with suspicion, watched carefully and thoroughly investigated by means of roentgen-ray and physical examination. Sometimes only the bronchoscope can differentiate between "drowned lung" and "lung abscess."

As soon as the abscess is definitely localized, bronchoscopic treatment should be instituted. If an adjacent pneumonic involvement has taken place, this procedure should be withheld until its subsidence. Frequent physical and roentgen-ray examinations should be made during the course of treatment. If no improvement follows six treatments, other forms of treatment should be instituted. Improvement is noted by lessened cough and expectoration, disappearance of the odor, clearing of physical signs and improvement of the roentgen-ray picture. When this occurs, continue the treatments regardless of the number required.

In these treatments general anesthesia should not be used. At first, hypodermic injections of morphin, and cocain locally are necessary; as a rule these can soon be omitted. On the first examination, the location of the abscess is determined, pus is secured for study and an autogenous vaccine prepared. Subsequent treatments are chiefly for the purpose of securing drainage. In early cases inflammatory swelling of the draining bronchus is the usual obstruction to drainage. Such cases are aspirated and the mucosa treated with a weak astringent solution. In older cases, where granulations block the passage, gentle swabbing, or crushing by forceps along with aspiration is usually necessary. Weekly treatments are then given. Each time as much pus as can be aspirated is removed, the area thoroughly cleansed and antiseptic oil applied. The usual duration of such treatment is from five to six minutes.

The time required to establish a cure, within limits, varies directly as the age of the abscess. In a series of eighteen cases so treated, eight patients have been clinically cured, eight clinically improved and two referred to the surgeon unimproved.

Dr. Lukens drew the following conclusions:

1. Bronchoscopy is indicated in all cases of pulmonary abscess as a diagnostic measure.

2. Pulmonary abscesses should be drained by the bronchoscope at the earliest possible time after localization of the lesion.

3. Bronchoscopy, in trained hands, is a safe procedure in all properly selected cases of pulmonary abscess following tonsillectomy.

TRACHEOBRONCHIAL ASTHMA, OBSERVATIONS ON BRONCHOSCOPIC STUDIES. Presented by DR. WILLIAM F. MOORE.

DR. MOORE reported a series of twenty-five cases of bronchial asthma treated bronchoscopically. These cases, which were all subjected to protein studies, were classified in two divisions. (1) Those patients having an active, evident, suppurative tracheobronchitis, and (2) those having a bronchoscopically evident chronic passive congestion of the trachea and bronchii. The first group of cases respond best to treatment.

In the treatment the secretion is removed by sponging or aspiration through the bronchoscope. A solution containing ten drops of a 10 per cent. solution of cocain and twenty drops of epinephrin solution (1:1,000) in 30 c.c. of physiologic sodium chlorid solution is instilled after treatment. Five cubic centimeters is placed in each main stem bronchus. Autogenous vaccine therapy is inaugurated one week after the first treatment.

Of the twenty-five asthma cases reported, seven showed no tracheobronchitis. Three of these patients were given temporary relief by treatment. The others were not improved. The remaining eighteen had evident tracheobronchitis. Sixteen of these patients were markedly improved by the treatment outlined, one showed slight improvement and one no apparent change.

CILIARY INHIBITION IN TRACHEOBRONCHIAL ASTHMA. Presented by DR. GEORGE R. MOFFITT (by invitation).

DR. MOFFITT, by means of lantern slides and microscopic preparations, demonstrated the types of ciliary motion present in the epithelial cells of the lower respiratory tract. He stated that coincident with clinical improvement following bronchoscopy, the cilia of the tracheal epithelial cells became more active and numerous. He described two types of epithelial cells present in the tracheal mucosa. One was of a spherical shape, the other of a columnar variety, both were provided with cilia and a basal elongated tapering process.

From his studies he estimated that one healthy epithelial cell possesses about 480 cilia, each of which moves 360 times per minute.

DISCUSSION

DR. ZINN, Baltimore (by invitation), has treated a number of asthma patients by means of the bronchoscope, with results that cause him to feel that the procedure is justifiable and of considerable promise. One patient treated six times with the bronchoscope and application of 5 c.c. of 20 per cent. gomenol has been free from asthmatic attacks for the first time in five years. Another, an adult male, suffering from severe bronchial asthmatic attacks and who was negative to all pollen tests, after the third treatment was able to return to work and since that time has had no recurrence. He emphasized the wisdom of careful selection in cases to be so treated. If no bacterial tracheitis is present, the patient will probably not be benefited. In his cases *Streptococcus viridans* and hemolytic streptococcus were the usual organisms.

DR. CROWELL demonstrated several specimens of bronchial casts, procured from patients treated in the Jackson Clinic.

CONTRAINDICATIONS TO BRONCHOSCOPY. Presented by DR. ELMER H. FUNK.

DR. FUNK stated that the number of contraindications to the foregoing procedure varies inversely as the skill of the examiner. The following list of contraindications was given.

1. No patient not thoroughly studied should be submitted to this maneuver. This study should include careful history and physical examination, sputum, blood and urine tests, roentgen-ray pictures and occasionally protein reactions.
2. Aortic aneurysm.
3. Recent massive hemorrhage (exceptions occasionally depending on individual case).
4. Active tuberculosis.
5. Moribund patients.
6. Diffuse pulmonary suppuration, such as purulent pneumonia, multiple abscesses or peripheral lung abscess.
7. Severe complications; some intercurrent serious condition such as brain abscess, typhoid fever, and so forth.

He gave as a general clinical rule that, where needed for diagnosis or treatment, the bronchoscope should be used when no clear contraindication is present.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES. Presented by DR. LOUIS H. CLERF.

DR. CLERF showed an interesting series of roentgenograms from a group of seventy-five cases, in which foreign bodies of various sorts were demonstrated and removed by means of the bronchoscope. In the diagnosis of the presence of foreign body in the lungs, the services of the internist and roentgenologist are indispensable. Limitation of motion and obstructive emphysema of the affected side are the most valuable aids in making a positive diagnosis where no opaque bodies are concerned.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES. Presented by DR. GABRIEL TUCKER.

The series of roentgenograms presented by Dr. Tucker demonstrated foreign bodies of all descriptions lodged in the esophagus from which they were removed by esophagoscopy. The necessity of roentgen-ray studies both by means of plates and the fluoroscope was stressed. He explained the mechanical emphysema occurring in the pulmonary foreign body cases in the following manner. The swelling and edema of the bronchus due to the irritation caused by the foreign body, narrows the lumen and permits the foreign body to assume a valve-like action, allowing air to enter but preventing its escape. After a time under such conditions, fluid secretions also are retained and the conditions known as "drowned lung" with subsequent atelectasis follow. The effect of moisture and warmth on certain forms of foreign bodies is very great. An example of the changes produced by the physical conditions is well illustrated by the bean, which swells to about two and a half times its usual size.

THE DIAGNOSIS OF NONOPAQUE FOREIGN BODIES IN THE LARYNX AND TRACHEA. Presented by DR. WILLIS F. MANGES.

DR. MANGES showed many lantern slides illustrating roentgenograms of laryngeal and tracheal foreign bodies. A dyspneic child must always be regarded as a potential foreign body patient, regardless of a negative history. In a nonopaque foreign body, obstructive emphysema is the most important early roentgenologic finding. Later "drowned lung" and atelectasis frequently follow, if only one lung or a portion of one lung is affected.

Book Reviews

DISEASES OF THE NOSE, THROAT AND EAR. Edited by A. LOGAN TURNER. Price, $5.50. New York: William Wood & Company, 1924, pp. 413.

This volume, profusely illustrated, is compiled by A. Logan Turner in collaboration with J. S. Fraser, W. T. Gardiner, J. D. Lithgow and G. Ewart Martin, all of the Ear and Throat Department of the Royal Infirmary, Edinburgh, and Douglas Guthrie of the School of Medicine of the Royal College, Edinburgh.

The chapters on the anatomy and diseases of the paranasal cavities are contributed by A. Logan Turner. This able clinician and teacher has given us, in a somewhat concise form, one of the best texts on this subject we have seen in the English language, and the equal of any text that has so far appeared in any foreign tongue. Dr. Gardiner contributes the chapter on the diseases of the nose; Dr. Guthrie the section on the pharynx and nasopharynx and Dr. Lithgow the chapters on the anatomy and diseases of the larynx. The section on endoscopy is written by Dr. Martin. Dr. Fraser, in an admirable section of 145 pages, contributes the chapters on the anatomy, physiology and diseases of the ear.

This book covering the field of otolaryngology is an admirable text for the use of undergraduate students in medicine, and its teachings will be a valuable and safe guide for men who are practicing in this special field. It contains very few statements with which we are not in full accord. Logan Turner's attitude toward such problems as those relating to complications from sinus disease will have a wholesome, steadying influence so much needed to counteract radical views expressed by some recent writers. The recommendation of ethyl chlorid as a general anesthesia for the tonsil and adenoid operation will hardly find sympathetic response in this country, where ethyl chlorid as a general anesthesia is relegated to the same class as chloroform as being less safe than ether or nitrous oxid or the new ethylene gas anesthesia. The use of the Guttstein curet for the removal of adenoids has been given up in this country for what we believe is a much better instrument, the La Force adenotome. Few Americans, we suspect, still make use of the digital examination for determining the presence of adenoids.

The chapters on the diseases of the ear are particularly well written, and with the able presentation of the known facts regarding the pathology of labyrinth diseases, should do much in clarifying in the minds of many who are practicing otology in this country the fundamental facts concerning incurable deafness.

The chapters on the anatomy and physiology of the internal ear seem rather abbreviated. The statement on page 251 that Ewald was an exponent of the telephone theory is, of course, a mistake. Ewald takes great pains to explain that his theory of sound perception is as much a theory of peripheral tone analysis as is the resonance theory of Helmholz. The author has fallen into the common error regarding the designation of the several tuning forks. For example, the fork vibrating 32 dv. he designates as C whereas it should be designated as C_1. The proper designation of the fork vibrating 64 dv. is C. Again he designates the fork vibrating 256 double vibrations as C^1 whereas this should be c^1. It is refreshing to see the statement that otosclerosis is a very common disease. The idea still seems to persist, in this country at least, that this is a relatively rare condition. The warning expressed on page 352 "against exaggerating the effect of intranasal disease in predisposing to affections of the ear" is very timely.

FACIAL SURGERY. By H. P. PICKERILL, C.B.E., M.D., M.S., Surgeon-in-charge of Facial and Jaw Department, Dunedin Hospital, etc., etc. Sidcup. With introduction by Sir. W. Arbuthnot Lane. Cloth. Price $6.50. Pp. 159, with more than 225 illustrations. New York: William Wood & Co. Edinburgh: E. & S. Livingstone, 1924.

Dr. Pickerill, through the unfortunate circumstances of war, was able to develop plastic surgery and lend individuality to his work. No doubt, as he states, the advances made for the alleviation of the condition of facial patients during the war have been utilized in the treatment of lesions of the face in civilian practice. The author has therefore divided up his treatise into three parts: Part I deals mainly with the principles, methods, and technic of facial surgery; Part II takes up the application of these methods to war surgery, and in Part III he deals mainly with that type of work in civilian practice.

Since this book is one of an individual design, the author does not attempt to develop the subject from the standpoint of a textbook, but has only developed those points which have been used by himself and found satisfactory. In fact, he has even hesitated to describe the more standard operations which are found in most surgical texts. His method of illustrating is practical and the reviewer is in sympathy with many of his views.

The principles which the author lays down, are presented in a most concise and simplified manner, as is most of the subject matter. In the text, describing the author's military experience, it does not differ greatly from other texts along the same lines but the author must be complimented on his manner of presentation and his results.

His method of closure of cleft palates by a combination of the Brophy, Lane, and Langenbeck methods, together with skin grafting, making both a surgical and mechanical restoration possible, is interesting and sounds feasible. Also his treatment of facial paralysis, by grafting the temporal and masseter muscles respectively into the orbicularis oculi and orbicularis oris muscles, is interesting. He claims for this method the voluntary control of the eye and reduction of characteristic facial deformity. This, of course, takes for granted that the muscles of the third, fourth, fifth (motor branch) and the sixth are performing this function. The illustration, however, directs it toward the temporal and occipito frontalis, which are themselves supplied by the seventh. If the author does get any result at all, it is, no doubt, through scar formation or cicatrization.